PSYCHOLOGY AROUND US

FOURTH CANADIAN EDITION

OGDEN • BOYES • FIELD • COMER • GOULD

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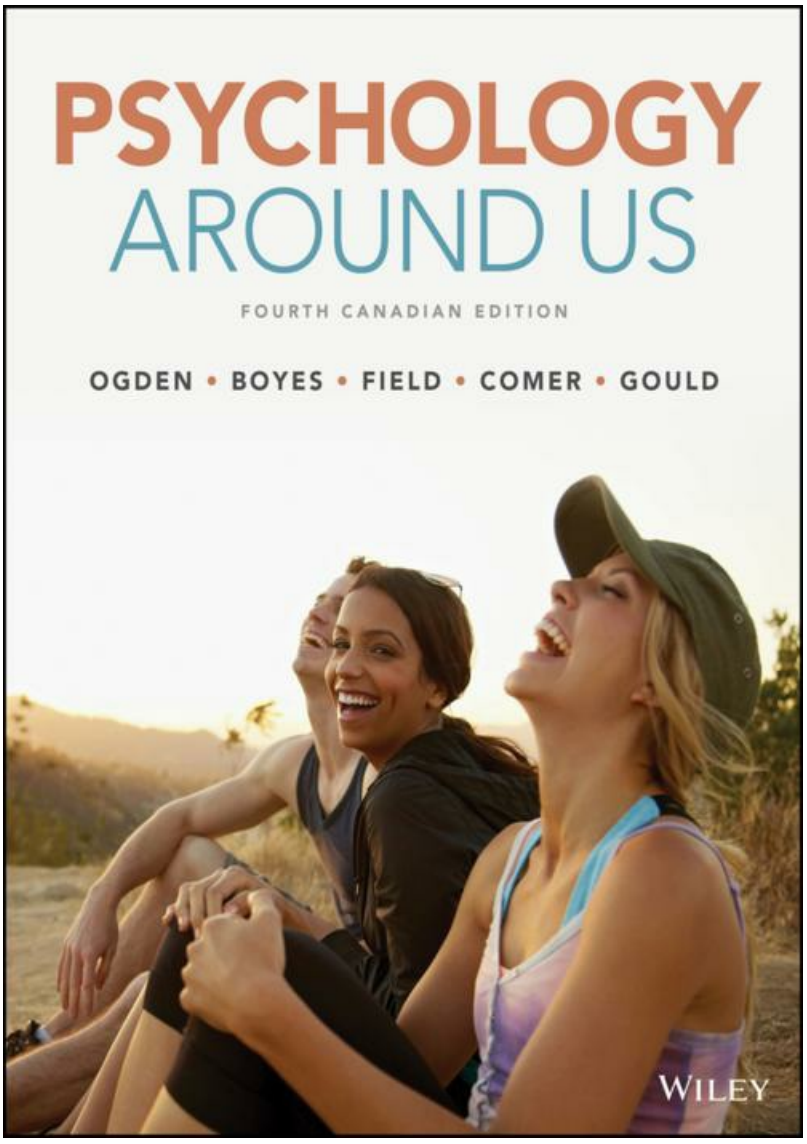
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Psychology Around Us, Canadian Edition

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Psychology Around Us

Fourth Canadian Edition

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About the Authors

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MICHAEL BOYES has taught at the University of Calgary in the Department of Psychology for 35 years and has received the University of Calgary Student Union Teaching Award. He publishes, consults, and runs courses and workshops in the areas of cognitive and psychosocial development and identity in families, children, adolescents, and emerging adults, as well as in programs aimed at optimizing student experiences in transitions to their post-secondary developmental pathways and with adults who need to engage in midlife career and identity pivots. He assists with the development and telling the stories (evaluation) of programs by and for urban Indigenous children, youth, and families and programs dealing with domestic violence. He has also served as an expert witness in cases related to matters of adolescent consent.

EVELYN FIELD is a full professor at Mount Royal University in the Department of Psychology, where she has taught for over 12 years. She has published numerous scientific articles and co-authored three books: *Sex Differences: Summarizing More than a Century of Scientific Research*, the Canadian edition of *Sexuality Now: Embracing Diversity, and Psychology YOU*, a career guide for psychology undergraduates. Field is a contributing author to several other textbooks, including *Biology on the Cutting Edge: Concepts, Issues and Canadian Research around the Globe* and previous editions of *Psychology Around Us.* She has received awards from the Natural Sciences and Engineering Research Council of Canada (NSERC), the Alberta Foundation for Medical Research, and the Canadian Institutes of Health Research, and is a recipient of the Governor General's Gold Academic Medal. She completed her studies in neuroscience at the Universities of Lethbridge and Calgary, and the Marine Biological Laboratories in Woods Hole, Massachusetts. Field has been nominated for, and received, several awards for teaching excellence, including a recent Distinguished Faculty Award for distinction in teaching, scholarship, and service at Mount Royal University. Her research focus is in the areas of neuroscience, sexuality, and the scholarship of teaching and learning, where she focuses on integrating creativity and technology into the classroom.

RONALD COMER has taught in Princeton University's Department of Psychology for more than 35 years and has served as Director of Clinical Psychology Studies for most of that time. He has received the President's Award for Distinguished Teaching at the university. Comer also is the author of the textbooks *Abnormal Psychology*, now in its seventh edition, and *Fundamentals of Abnormal Psychology*, now in its ninth edition, and is the coauthor of

Case Studies in Abnormal Psychology. He is the producer of various educational videos, including The Introduction to Psychology Video Library Series. In addition, he has published journal articles in clinical psychology, personality, social psychology, and family medicine.

ELIZABETH GOULD has taught in Princeton University's Department of Psychology for the past 15 years. A leading researcher in the study of adult neurogenesis, she has published numerous journal articles on the production of new neurons in the adult mammalian brain. Gould has been honoured for her breakthrough work with a number of awards, including the 2006 NARSAD Distinguished Investigator Award and the 2009 Royal Society of the Arts Benjamin Franklin Medal. She serves on the editorial boards of *The Journal of Neuroscience*, *Neurobiology of Learning and Memory*, *Biological Psychology*, and *Cell Stem Cell*.

To the Instructor

Psychology is all around us. If ever there was subject matter that permeates our everyday lives, it is psychology. Behaviour occurs everywhere, and mental processes affect all that we do; therefore, the study of individual behaviour and mental processes can help shed light on a wide range of events and issues.

Psychology Around Us**, Fourth Canadian Edition**, helps open students' minds to the notion that psychology is indeed around them every day and that its principles are immediately applicable to a whole host of life's questions. It also features classroom-proven pedagogy to keep students engaged and help them master the material.

We are committed to demonstrating for students the relevance and interconnectedness of all areas of psychology. We aim to encourage students to examine not only what they know about human behaviour but how they know it, and seek to open students up to an appreciation of how psychology pervades the world around them and how it can assist them in seeing, understanding, and optimizing their experiences within the world.

About the Text

Our content is unique in that while each topic is still covered in its own chapter, the integrated nature of psychology permeates every chapter. For example, how can students get a full appreciation of memory without discussing the vital role of the hippocampus, or how memory develops, or how Alzheimer's disease changes memory function? ***Psychology Around Us*****, Fourth Canadian Edition** is a truly integrated product—one that brings all of these elements together into one, complete discussion of any given topic of psychology.

This integration is accomplished by offering a thorough, current presentation of the concept with explanations, applications, and research (including key Canadian research) of each topic, but also includes sections on neuroscience, development, and dysfunctions that illustrate how each of these key areas is tied to other areas of psychology. These sections serve to present psychology as a united and integrated discipline, therefore showing students "the big picture."

New to this Edition

Our goal for the fourth Canadian edition of ***Psychology Around Us*** was to continue to make it as engaging as possible for students and as supportive as possible for instructors. We asked reviewers to provide us with constructive input in terms of the strong science base of the coverage, their own concerns regarding key topics for inclusion, and what their students found engaging about the material—what they wanted to know, what questions they asked, and what seemed to most pique their interest. We have incorporated most of the suggestions made by reviewers in this edition.

Currency Changes

We updated and added hundreds of current, relevant references to ensure that readers are provided with access to the most up-to-date research related to the topics covered and to make the research foundations of the theories, concepts, and findings discussed current and clear. The text also features an updated and inclusive graphics and photo program.

Topical and Organization Changes

Chapter 1 – Psychology: Yesterday and Today

Indigenization was introduced in an introductory feature box tying in with the Truth and Reconciliation Commission's 94 calls to action.

The "Roots in Psychology" section was rewritten to make it more student friendly and accessible.

Information was added on industrial/organizational psychology, as well as cognitive neuroscience and applied areas of psychology such as sports psychology.

Chapter 2 – Psychology as a Science

The section discussing eugenics was re-written to provide a clearer historical context and a sharper tie-in for the Canadian content on that topic.

The introduction to the recurring content thread in the chapter on the relationship between violent video game play and aggressive behaviour was reworked to include citations to and findings arising from two recent large meta-analyses looking at this question.

Chapter 3 – Neuroscience

The chapter was reorganized, starting with the big picture of how the nervous system is organized and working down to the details of how neurons communicate with one another.

The discussion of our current knowledge regarding treatment of spinal cord injuries was updated.

The discussion of the action potential and synaptic transmission was expanded, with new figures and diagrams to clarify how it works and to better support students' understanding of the concept.

The learning objective that focuses on acquired central nervous system injury and lateralization of brain function was revised and updated.

Chapter 4 – Human Development

The discussion on cohort-sequential designs was expanded, including better visual imagery.

Some feature boxes took a more applied focus: *Psychology Around Us* boxes deal with the role of fathers in child development (featuring Canadian data as well as a case report on an Indigenous father) as well bullying in schools and the workplace; *Indigenous Experiences* boxes address the role of residential schools in breaking

familial bonds and disrupting identity development.

Other boxes took a more programmatic focus on development, with *Positive Psychology* boxes featuring Aboriginal Head Start Programs, the Alberta Family Wellness Initiative, and the *Practically Speaking* box focusing on how access to quality childcare in Canada varies by socio-economic status.

Chapter 5 – Sensation and Perception

Information on thresholds was expanded and information was added on signal detection.

The text was edited to clarify concepts and increase student understanding.

Feature boxes were added on current topics of interest to students, such a COVID-19, managing chronic pain, and throat singing.

Chapter 6 – Consciousness

The discussion of contemporary definitions of consciousness, including states of consciousness, was expanded.

The sleep disorder section was expanded to include disorders as listed in the International Classification of Sleep Disorders, including excessive daytime sleepiness, and a new section was added on circadian rhythm sleep disorders, which often affect young people.

The section on psychedelics was updated and expanded to include drugs commonly found in this category, such as psilocybin, ketamine, and DMT.

Chapter 7 – Learning

Topics were streamlined or expanded to enhance student understanding.

Feature boxes were added on the role of learning in aspects of day-to-day life, including the role of punishment in disciplining children, academic success, and how fear influences learning. Other boxes focus on the role of learning therapeutically, such as using robots to teach autistic children about emotions, the role of habituation in neuropsychiatric disorders, as well as predicting self-harm behaviours through negative reinforcement.

Chapter 8 – Memory

Information on flashbulb memories was updated and expanded.

The discussion on dementia was expanded and two feature boxes on the topics of memory loss and on slowing cognitive decline in older adults were added to support this expansion.

A presentation of practical study techniques, including the PQRST study method, was modified.

A discussion on cannabis and memory loss was added.

Feature boxes were added that address a story of a mistaken eyewitness account and a

man wrongfully accused and jailed, an account of highly superior or severely deficient autobiographical memories, and the impact of oral history in Indigenous cultures.

Chapter 9 – Language and Thought

The section relating to Koko the gorilla was reworked given her death.

Where appropriate, material relating to COVID-19 and its impact upon communications was added (e.g., interpretation of social distance in conversation).

Material was added into the end of the theories of language development section discussing Roy's work of child-directed speech and "word births" studied through the Human Speechome Project.

New information on the neuroscience of marketing was added to the section on the language and the brain.

The leap in research on autopilot programs for automobiles was added to the *Psychology Around Us* feature.

Chapter 10 – Intelligence

The information on brain function and intelligence was expanded to include a discussion of how brain activity correlates to measures of intelligence.

Chapter 11 – Motivation and Emotion

Thirst and binge eating disorder were added to the first of two learning objectives focused on biological motivations.

The second learning objective on biological motivations was renamed "Mate Choice and Sex." Information on mate choice was added and this section was updated to reflect current perspectives and research in psychology.

A new section on the individual factors of psychological motivations was added, discussing how unconscious/conscious, approach/avoidance, intrinsic/extrinsic, and fixed/growth mindsets—as aspects of who we are as individuals—affect motivation.

The discussion of motivation and the brain was expanded, with several new photographs and diagrams added throughout the chapter.

Chapter 12 – Personality

Sections on the Trait Approach and the Trait-Based Approach to Assessment were reorganized and re-written to better reflect the historical emergence of this central part of the discipline of personality psychology. As a result, the discussion now follows the more sensible, integrated line of tracking the emergence of the trait approach through the work done on the development of assessment and the building of empirically supported inventories.

The closing section on Personality Disorders was reworked to provide a clear focus on recent work on a dimensional approach to personality disorders, much more in line with how personality is considered within psychology.

Chapter 13 – Social Psychology

The impact of the COVID-19 pandemic on stress, anxiety, and uncertainty especially though its impact of norms for social engagement and behaviour was discussed.

Content was added to ensure that reactions to incidents of police violence toward black and Indigenous people was appropriately linked to social psychology theory and research on stereotypes, prejudice, and bystander intervention. The ways that work in social psychology links into concerns and issues of systemic racism, particularly in relation to Canada's Indigenous people, are noted and discussed.

Chapter 14 – Stress, Coping, and Health

Meditation was added to Learning Objective 3.

New feature boxes have expanded the material on health and stress including reference to stress during the time of COVID-19.

Chapter 15 – Psychological Disorders

Material was added to the Anxiety Disorder section related to significant anxiety-related issues arising from the COVID-19 situation.

Statistics on Canadian Indigenous suicide rates were updated.

Material was added in the Depression section on social prescribing practised in the United Kingdom where lonely people are prescribed participation in gardening clubs, etc. at health system expense.

The opening part of the section on Personality Disorders was reworked to better link it with work done in Chapter 12 (Personality) also on personality disorders. Material was added in Chapter 15 to clarify the outcomes of the intense discussions that occurred within the American Psychiatric Association DSM committee on personality disorders over whether personality disorders should be considered categorically as in previous DSM editions or as extremes on an array of personality dimensions. We feel that the way this information is now presented in this edition edition clarifies the relationship between "normal" personality theories and personality disorders.

Chapter 16 – Treatment of Psychological Disorders

Drug and treatment statistics and research support were updated.

Long-term and short-term approaches to psychodynamic therapies were expanded and clarified.

An introduction to and in-depth discussion of third-wave cognitive behavioural approaches was added.

The section on efficacy in psychotherapy was expanded.

A feature box was added providing practical support for students with advice on selecting a therapist.

New features were added with a strong focus on inclusion, with boxes on well-being in culturally diverse students, finding comprehensive community care for extremely

vulnerable individuals, effective programs for Indigenous people, involving Elders in mental health care for Indigenous patients, and effective treatment options for those diagnosed with borderline personality disorder.

New Pedagogical Features

Indigenous Experiences

Education, including post-secondary education, was given a central role in the Truth and Reconciliation Commission (TRC) of Canada's 94 calls to action. The TRC was tasked with documenting the experiences of survivors, families and communities affected by Indian Residential Schools (IRS). The mandate of the TRC was to find out the truth about what happened in residential schools and to inform all Canadians about what transpired in these schools and lead the country toward reconciliation and healing.

The Indigenous Experiences feature, one in each of the first three chapters and two in the rest of the chapters, addresses Indigenous perspectives as recorded in TRC reports or presented in research that is relevant to Indigenous people in connection with one or more related topics in each chapter.

Positive Psychology

Two of the **Psychology Around Us** features in each chapter (with the exception of Chapter 1) highlight research based on positive psychological perspectives. Each is focused on the application of human strengths and positive principles rather than on the reparation of negative life impacts.

Psychology@Work

A video series in the online courseware and margin notes link the basic concepts presented in an introductory psychology course to industrial/organizational psychology workplace and organizational applications and helps students understand how what they learn relates to their future lives and careers.

Continuing Features

Your Brain and Behaviour

In recent years neuroscience has been tied to virtually every subfield of psychology. Remarkable brain imaging studies, in conjunction with animal studies, have helped us to identify the neural mechanisms of everyday experience. Accordingly, ***Psychology Around Us*, Fourth Canadian Edition**, incorporates neuroscience information into chapters where it has traditionally been absent, such as social psychology and consciousness.

In addition, this edition offers a key teaching feature—Your Brain and Behaviour—with the exception of Chapters 1 and 2, this feature has been incorporated into each chapter. Your Brain and Behaviour segments focus on how the brain determines our behaviours in a variety of scenarios, such as public speaking, eating pizza, our reactions to robotic figures,

and psychopathy. This section will help students understand the importance of the interaction of our brain's control of our behaviours with the environments we live within. These features, which include neuroimages and findings from both human studies and relevant animal experiments, draw students into the brain and provide them with up-to-date information about the neural mechanisms at work during their everyday experiences. Each feature includes questions that allow students to test their knowledge. Regardless of their background in neuroscience, students come away intrigued by material that has traditionally been considered difficult.

Chapter Opener Outline

Every chapter begins with an outline of the main headings in the chapter, with the accompanying learning objective. Each chapter also starts with a description about a person or situation to introduce concepts and interest students in the chapter content. This introductory material helps to give readers an overview of the chapter and helps to prepare them for the material they will need to learn.

Guided Learning

A **Learning Objective** for each chapter section identifies the most important material for students to understand while reading that section.

Following each section is a **Before You Go On** feature with questions that help students check their mastery of the important items covered. **What Do You Know?** questions prompt students to stop and review the key concepts just presented. **What Do You Think?** questions encourage students to think critically on key questions in the chapter. Answers to Before You Go On questions are provided in the online courseware.

Special Topics on Psychology In Our Daily Lives

Each chapter highlights interesting news stories, current controversies in and around psychology, and relevant research findings that demonstrate psychology around us.

> The **Psychology Around Us** boxes highlight how psychology affects us in our everyday lives, in every way, with examples from Canada and around the world.
>
> The **Practically Speaking** boxes emphasize the practical application of everyday psychology.

Thorough Coverage

***Psychology Around Us*, Fourth Canadian Edition**, contains 16 chapters that cover key topics of psychology in depth. Instead of combining chapters on stress and emotion, or psychological disorders and their treatment, each topic is given full coverage in its own, separate chapter. This gives you ultimate flexibility in determining how much time you want your students to devote to each topic. For example, if you want to cover neuroscience briefly, then simply assign the relevant pages from that chapter; but if you want to cover neuroscience in depth, you have a full chapter at your disposal that contains detailed and integrated coverage of the topic.

Chapter Summary

The end-of-chapter summary reviews the main concepts presented in the chapter with reference to the specific Learning Objectives. It provides students with another opportunity to review what they have learned as well as to see how the key topics within the chapter fit together. End-of-chapter Self-Study Questions have been added, with answers provided, to help students do a quick check of their understanding of key concepts covered.

Student Resources

Students will find support materials in Wiley's online courseware that will help them develop their conceptual understanding of course material. Some of the resources available for students include the e-textbook, videos, animations and interactives, and multiple practice opportunities using multiple choice and true-false questions.

E-Textbook Characteristics

E-Textbooks are complete digital versions of the text that help students study more efficiently as they:

- Access content online and offline on their desktop, laptop, and mobile device
- Search across the entire book content
- Take notes and highlight
- Copy and paste or print key sections
- Create a personalized study plan
- Share insights and questions with peers

Videos

The new **Psychology@Work** video series links the basic concepts of an introductory psychology course to research and practice in industrial/organizational (IO) psychology. In recent years, there has been considerable interest in increasing the coverage in introductory psychology textbooks and courses of the broad array of work done by IO psychologists. Mainly, this has been driven by members of the Society for Industrial and Organizational Psychology (SIOP) who work in IO programs within psychology departments across Canada wanting to engage students and drive interest in their undergraduate and graduate courses. There are very real benefits of early, quality exposure to IO psychology to psychology majors as well as to the majority of introductory psychology students who are not psychology majors. For example, market survey research shows that the average starting salaries of master's level prepared IO students in corporate or IO consulting work is higher than the average starting salaries for Ph.D.-level clinical psychologists (Rajecki, 2012).

In addition, all students who head out into the general job market after completing their undergraduate studies will experience a lot of applied IO psychology as it informs hiring practices and decision making, personnel selection, training, and retention. The new Psychology@Work video series features the range of ways that IO psychology impacts

psychology and the world around us. One or two videos with chapter-relevant IO content are linked into all but chapters 6 and 8 with callout notes and marginal captions. Considered together, the videos cover almost all core areas of research activity and practice of IO psychologists as detailed by SIOP. Associated questions provide opportunities for students to reinforce what they have learned.

Instructor Resources

The **Instructor's Manual** presents teaching suggestions for each chapter and includes ideas for lecture classroom discussions, demonstrations, and videos.

Every chapter contains a **PowerPoint Presentation** with a combination of key concepts, figures and tables, and problems and examples from the textbook. The instructor's version also includes notes for additional discussion points or activities you can use during your lecture. In addition, each PowerPoint contains links to videos and animation tutorials available for that chapter.

The **Test Bank** contains over 200 questions per chapter with a variety of question types—multiple choice, true/false, short answer, and essay. The Test Bank is available in a Word® document format, as well as a Computerized Test Bank, which allows you to upload the test bank into your learning management system. The questions are available to instructors to create and print multiple versions of the same test by scrambling the order of all questions found in the Word version of the test bank. This allows users to customize exams by altering or adding new questions.

A pre-created **Homework Assignment** in the online courseware will offer 10 question per learning objective. Instructors can modify these assignments or assign them as is.

Practice Quizzes offer several questions per learning objective that students can use to test their knowledge of the chapter content.

Clicker questions offer 10 to 15 questions per chapter to initiate discussion in class (both online and in person).

An MCAT correlation guide links MCAT topics to chapters and sections in ***Psychology Around Us*, Fourth Canadian Edition**, making it easy for students to use the content to prepare for the MCAT exam.

The **Wiley Psychology Weekly Update** site (http://wileypsychologyupdates.ca) features articles and videos to help keep learners up-to-date on the field of psychology and illustrates the real-world significance of psychology in everyday life. Discussion questions are provided to help guide an understanding of the article or video and to encourage class participation.

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The National Centre for Truth and Reconciliation (NCTR) was created to preserve the residential school experiences that were documented by the TRC. We are grateful to the NCTR for allowing us to reproduce its logo with the Indigenous Experiences features in the text. The flame at the centre of the logo symbolizes the seven fires that represent the Seven Sacred Teachings of respect, honesty, courage, love, humility, wisdom, and truth. The fire represents the responsibility of every Canadian to ensure that the fires of reconciliation burn bright. The image of the two birds that appears in the flame represents the spirits of all Canadians that are set free when the truth is told and the relationships that we need to build for healing to take place. The third small flame represents all the children who are yet to be born to whom we owe a better future. The circle around the flame protects it while the gaps in the circle signify that people from all directions are welcome to join the journey of reconciliation.

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CHAPTER 1
Psychology: Yesterday and Today

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CHAPTER OUTLINE

What Is Psychology?

LEARNING OBJECTIVE 1 Define *psychology* and describe the goals and levels of analysis psychologists use.

Psychology's Roots in Philosophy

LEARNING OBJECTIVE 2 Describe the influences of early myths, rituals, and ancient Greek philosophies on psychology.

The Early Days of Psychology

LEARNING OBJECTIVE 3 Name important early psychologists and describe their major theories and research methods.

Twentieth-Century Approaches

LEARNING OBJECTIVE 4 Summarize the major principles of the psychoanalytical, behaviourist, humanistic, cognitive, and neuroscience approaches to psychology.

Psychology Today

LEARNING OBJECTIVE 5 Describe the three major branches of psychology and summarize key trends in psychology.

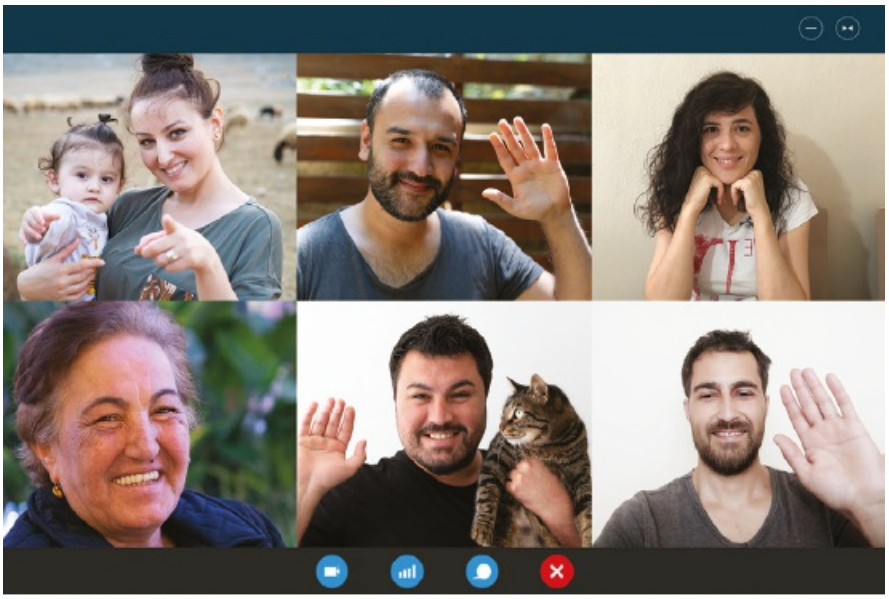
You have been looking forward to Friday night all week. You have had a long week studying for exams, writing papers, and working. You change into your most comfortable sweatpants and sit down in front of Netflix. Before you settle into your show, you check your Instagram feed and Snapchat and Facebook accounts. Almost right away, instead of feeling tranquil you feel anxious. Gone is the desire to relax and recover from your tough

week. Instead, you now feel left out because you know that everyone, absolutely *everyone*, is having a better time than you. FoMO (fear of missing out) has struck. Three quarters of young adults report experiencing FoMO (Przybylski et al., 2013), with most users reporting that Snapchat makes them feel worse than Facebook (Utz, Muscanell, & Khalid, 2015).

Research shows that FoMO makes people feel worse about themselves (Przybylski et al., 2013), and the more time a person spends on social media, the more likely they are to experience FoMO (Baker, Krieger, & LeRoy, 2016). FoMO may also contribute to health problems (Riordan et al., 2015; Scott & Woods, 2018). With FoMO, people cannot help but compare themselves to others, asking, "What if it *is* just me? What if other people really *do* have this much more fun than me? What if I really *am* being left out?" What is the fear here? Is a person afraid of missing an event or afraid that friends are going to stop caring about them if they are not consistently present?

With the advent of physical distancing amid the COVID-19 global pandemic, researchers were provided with an opportunity to examine this question in real time. On the one hand, individuals experiencing FoMO were not able to go anywhere; but on the other hand, neither was anyone else. So, was the critical variable for mental health the fear of missing out on social opportunities or the fear that one is uncared for? (That is, did your friends listen when you said you needed a night at home, or did they leave you out because they did not care whether you joined them?) Researchers from Italy and Canada, Casale and Flett (2020), asked this question. They argued that since a person with FoMO cannot meaningfully resolve their fear of missing out during a pandemic—that is, since they cannot fear missing non-existent activities while in a period of physical distancing—the fear of not mattering would become a more compelling anxiety if this was the driver behind FoMO. "Mattering" is the belief that you are valuable to others and/or that you provide value to others. Deficits in perceptions of mattering are often associated with loneliness (Flett & Zangeneh, 2020). Casale and Flett suggest that regardless of whether or not an individual experiences FoMO, feeling that they matter to others would be vitally important to, and indeed, protective of, good mental health during the pandemic. However, if a person believes that they do not matter to others, they will feel uncared for, forgotten, and alone, with or without evidence that others were having a better time than them even while physically distant.

What does this research question tell us about psychology? First, psychology is about people and what motivates their behaviour. Second, psychology is a science. We know that evidence matters. Like all good researchers, Casale and Flett (2020) cite evidence and data to defend their arguments. Third, most psychological issues are complex and multilayered. Fourth, the work of researchers is often multidisciplinary and interconnected. Fifth, psychology is more than therapy; psychology encompasses many subfields, including biopsychology, cognitive psychology, developmental psychology, social psychology, and others.



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Social networking platforms A positive influence during the COVID-19 global pandemic.

As you read this book, you will see that psychology is around us every day in every way. We will discuss human development, studying how we mature and what shapes us as we age. We will look at motivation and emotion, exploring ideas about what shapes and motivates behaviour and how we think and feel about experiences. We will address how we acquire knowledge and formulate values and beliefs. We will examine how changes in the brain affect how we think, feel, and behave. Along the way, our goal is to help you gain insight not only into the attention-grabbing and sometimes bizarre things that can go wrong in our brains, but also into the often-overlooked but good things that often go right; for example, people were able to stay connected through the COVID-19 pandemic thanks to social media (see photo).

Every journey begins with a first step, and in this chapter, the first step is to learn what psychology is and how it developed into the discipline we have now. After that, we'll discuss where psychology originated and how it developed. Finally, we'll learn more about psychology today, including what psychologists do, where they do it, and what's new and changing in what they do.

What Is Psychology?

LEARNING OBJECTIVE 1

Define *psychology* and describe the goals and levels of analysis psychologists use.

From our earliest beginnings, people have been curious about the inner workings of the mind and have attempted to explain and predict the thoughts and emotions of themselves and of others. Today, the science of studying *mental processes* and *behaviour* is known as

psychology. Psychology as a discipline is concerned with empirically examining the mind and behaviour and determining how each is influenced by the psychobiology of the organism as well as the effects of the external environment.

> **psychology** the study of mental processes and behaviours.

Mental processes describe the activity of our brains when we are engaged in thinking, processing information, and using language. Mental processes include complex experiences such as thinking, imagining, and remembering. During psychology's early history, the primary method for exploring internal mental processes was to observe outward **behaviour**, our observable actions, and make inferences, or guesses, about what was happening in the mind. Since psychology became an experimental science in the nineteenth century, however, psychological researchers have sought more direct ways to examine mental processes. In fact, the advent of brain imaging and other forms of technology have enabled scientists to uncover fascinating connections between behaviour and mental processes and to move toward a more comprehensive view of how mental processes occur in various individuals and situations.

> **mental processes** activities of our brain when engaged in thinking, observing the environment, and using language.
>
> **behaviour** observable activities of an organism, often in response to environmental cues.

When psychologists study mental processes and behaviour, they generally have one of four goals in mind:

> ***Description***. Psychologists seek to *describe* very specifically the things that they observe (see Psychology Around Us 1.1). As you read this book, you'll see that psychologists have described phenomena ranging from how babies learn to talk to how we fall in love, how a human being is affected by early experience to how we make decisions, and more.

1.1 Psychology Around Us

Myths and Misconceptions

In their book, *50 Great Myths of Popular Psychology: Shattering Widespread Misconceptions about Human Nature*, Lilienfeld, Lynn, Ruscio, and Beyerstein (2010) argue that it is important to know about myths for three reasons: (1) they can be harmful; (2) myths can create indirect damage; and (3) accepting myths in one area impedes thinking in other areas. We will present research data throughout the book to counter common myths, but will this mean that by the end of the course you will be able to spot a myth when you see one? Educators argue that this is often not the case (Bernstein, 2017; LaCaille, 2015). To examine this question, Furnham (2018) examined student understanding of common myths and misperceptions in psychology. His results indicated that those who identified themselves as having "common sense"

or as religious or "right-wing," were better able to identify a myth. Furnam suggests that one way to debunk myths is to become informed and to be open to relevant information.

So, read each of the following statements and decide whether it is true or false.

People use only 10 percent of their brains. Electrical brain stimulations have not identified *any* inactive areas in the brain (Forsdyke, 2015).

It is better to express anger than to bottle it up. When people behave in an angry way their levels of aggression go up, not down (Lochman, Barry, Powell, & Young, 2010).

Some people are primarily right brained whereas others are primarily left brained. The typical brain works in an integrated fashion (Geib et al., 2017).

You can recall forgotten information under hypnosis. Forensic psychologists believe that hypnosis either has no effect on memory or that it distorts recall (Baltman & Lynn, 2016).

People with schizophrenia have two personalities. People with schizophrenia have only one personality; people with a form of dissociative identity disorder may have more than one personality, although even this idea is controversial (Renard et al., 2017).

Opposites attract. People are far more likely to choose romantic partners and friends who share similar personality traits (Johnson, 2016).

Some people look like their purebred dogs. True (Roy & Christenfeld, 2004).

Vedros & Associates/Getty Images

Explanation. Telling what, where, when, and how is sometimes not enough. A key goal for many psychologists is to answer the question of "Why?" As we'll see, psychologists have developed hypotheses and theories to *explain* a huge variety of events, from why people develop addictions to substances to why we get hungry.

Prediction. Psychologists also seek to *predict* the circumstances under which a variety of behaviours and mental processes are likely to occur. You'll learn later in this book, for example, about research that predicts the conditions under which we are most likely to offer help to a stranger in need.

Control. We often encounter situations in which we want to either limit or increase certain behaviours or mental processes—whether our own or those of others. Psychology can give students advice on controlling their own behaviours that ranges from how to limit unhealthy stress to how to increase what you remember from a class.

To describe, explain, predict, or control mental processes and behaviours, we need to recognize the many influences on them. All our thoughts and actions, down to the simplest tasks, involve complex activation and coordination of a number of levels—the levels of the *brain*, the *individual*, and the *group*. As you will see throughout this textbook, no psychological process occurs solely at one of these levels. Analyzing how the brain, the individual, and the group influence each other reveals much about how we function—insights that might be overlooked if we were to focus on only one of these levels alone (see **Table 1.1**).

At the *level of the brain*, psychologists consider the neuronal (brain cell) activity that occurs during the transmission and storage of information. They also focus on the structure of the brain and the genes that guide its formation. As we'll see later in this chapter, technological advances in the fields of molecular biology and brain imaging have made it possible to study how brain structure and activity differ from person to person and situation to situation (Tavor et al., 2016). For example, a psychologist studying the brain can now look at what parts of the brain are activated by the administration of a drug (Koob, 2018), or the brain changes resulting in increases in anxiety, depression, and sleep disruption following a traumatic brain injury (Ma et al., 2019).

At the *level of the person*, psychologists analyze how the *content* of mental processes—including emotions, thoughts, and ideas—form and influence behaviour. To use a computer analogy, this level relates to the software rather than the mechanical functioning, or hardware, of the brain. The level of the person includes ideas such as consciousness, intelligence, personality, and motivation, and considers issues such as how individual differences in personality account for emotional responding (Segerstrom & Smith, 2019) or of the role child maltreatment plays in later parenting behaviour (Savage et al., 2019). Although internal biological structures of the brain allow such person-level processes to occur, we cannot understand the processes unique to each individual, such as personality or motivation, without also studying this level.

Psychologists must also look beyond the individual to the *level of the group*. This perspective recognizes that humans are shaped by their social environment and that this environment changes over time. A *group* can be made up of friends, family members, or a

large population. For example, research at the level of the group might examine how immigration status impacts student perfromance in elementary school (Tardif-Grenier, Olivier, & Archambault, 2019) or the relationship between gangster culture and mental health in adolescents (Macfarlane, 2019). Often a large group shares a **culture**, a set of common beliefs, practices, values, and history that are transmitted across generations (see Indigenous Experiences 1.1). The groups to which people belong or perceive themselves to belong can influence their thoughts and behaviours in fundamental ways (Gummadam, Pittman, & Ioffe, 2016). Canadian culture is rooted in Indigenous history as well as that of early settlers and immigrants, resulting in a diverse population of mixed ethnic groups and cultures (Weinfeld, 2016). (See photo.)

culture a set of shared beliefs and practices that are transmitted across generations.

TABLE 1.1

The Levels of Analysis in Psychology

Level	What Is Analyzed	Example: Using Social Media
The brain	How brain structure and brain cell activity differ from person to person and situation to situation	What are the patterns of brain activation as people interact with "friends" online?
The person	How the content of the individual's mental processes form and influence behaviour	Are there personality factors that influence how much people use different types of social media? Can online social support or crisis resources improve people's decision making and quality of life?
The group	How behaviour is shaped by the social and cultural environments	What features of social networking sites, such as relative anonymity, ease of access, and lack of face-to-face contact, increase or decrease users' feelings of belonging and connectedness?

Levels of analysis. Each level interacts with the others.

1.1 Indigenous Experiences

The Shameful Chapter of Residential Schools in Canadian History

Canada's residential school system was a grievous injustice perpetuated against the Indigenous, Metis, and Inuit peoples of Canada. From 1880 to 1996, an estimated 150,000 Indigenous, Inuit, and Metis children were frequently forcibly seized, taken from their families, and sent far from their communities to attend one of 139 church- and/or government-sanctioned or -run residential schools. The goal of the schools was to assimilate Indigenous peoples into the dominant culture. Thousands of children never returned home, dying from neglect, diseases caused by appalling living conditions, and abuse. More than 3200 children are known to have perished while in

the residential school system, although many argue that the actual number is likely 5 to 10 times higher (Sinclair et al., 2012).

In 2006, the Indian Residential School Settlement Agreement (IRSSA) was approved. This agreement formally and legally acknowledged the trauma and suffering inflicted on Indigenous, Metis, and Inuit children by the residential school system. The IRSSA also provided restitution and reparation through initiatives intended to work toward a fair and equitable future for those who attended the schools and their families and communities. On June 11, 2008, then-Prime Minister Stephen Harper offered an apology and asked for forgiveness for the intergenerational damage and cultural dislocation caused by this policy. The apology was intended as a commitment to learn from this tragedy and as an assurance that such assimilative actions would never happen again (Miller, 2017; Niessen, 2017).

History and Art Collection/Alamy Stock Photo

The Qu'Appelle school at Lebret in what is now Saskatchewan opened in 1884. O.B. Buell, Library and Archives Canada, PA-182246.

Seeking contact In many areas, Indigenous families, denied access to their children, moved as close to the school as they were allowed.

The Truth and Reconciliation Commission (TRC) was established in 2008 as a required component of the IRSSA. A truth commission is an official body tasked with investigating the causes and consequences of past human rights violations in the hope of resolving conflict from the past. The mandate of this TRC was to gather the written and oral history of residential schools to inform all Canadians about the human rights violations in the residential school system and the lasting impacts it had on the students and their families. More than 7000 survivor statements and 5 million records were collected. An attempt was also made to document missing children and to create a record of deaths at the schools. Four summary reports, one exclusively devoted to recounting the stories of survivors, and 94 "calls to action" were released in June 2015 and the commission officially concluded in December 2015. The TRC formally concluded by stating that the residential school system amounted to cultural genocide (TRC, 2015).

The National Centre for Truth and Reconciliation (NCTR), at the University of Manitoba, is now home to all materials and testimony collected by the TRC. The NCTR is also tasked with continuing the journey toward reconciliation. One step toward reconciliation is knowing the truth about the history of residential schooling and its legacy. Without knowing the truth about past injustices, we cannot begin to rectify them.

In an effort to move toward reconciliation and healing, to acknowledge the destructive legacy of our shared history, and to value Indigenous perspectives and experiences, we will examine research and refer to the lived experiences of Indigenous people as we move through the textbook.

Critical Thinking Questions

Why do you think the TRC referred to the residential school system "cultural genocide"? Do you agree with this statement? Why or why not?

The 94 calls to action in the TRC's final report identify both *legacy recommendations* (focused on rectifying historical damage) and *reconciliation recommendations* (focused on improving ongoing wrongs). Which of these types of recommendations do you see as most important? Why?

When they conduct research, psychologists may focus on a single level of analysis. It is important to recognize, however, that activity does not take place only at one level or another. During even our most everyday activities, we are operating at all three levels at once. The levels also interact. Brain activity is affected by other levels, even by our broad cultural contexts. Similarly, changes in the biology of our brains can cause significant changes in our general state of being.

Let's go back for a moment to our earlier discussion of FoMO. If psychologists set out to understand behaviour involved in FoMO, they could examine it at various levels. Operating at the level of the brain, they could explore patterns of brain activation in users of social media suffering from FoMO to see what brain changes occur when they go online or seek to link to or interact with others. At the level of the person, psychologists could explore questions of early childhood experiences and personality to see whether there are certain characteristics related to the risk of developing FoMO. Finally, at the level of the group, psychologists might examine whether the need to compare ourselves with others can be used to promote happiness and life satisfaction. As you'll see throughout this book, the notion of multiple levels of analysis has played an important role in the development of psychological theories (Hagger, Chan, Protogerou, & Chatzisarantis, 2016).

Having examined what psychologists study and how they do it, let's next consider how psychology got its start, how historical and societal factors affected the way psychologists studied the mind and behaviour, and how perspectives and approaches vacillated over the discipline's rich and varied history. We'll examine how psychologists shifted their focus among the different goals and levels of analysis throughout psychology's history. You cannot truly appreciate psychology as it is now without a brief review of the growth and

development of the field as it was shaped to become the discipline we have today.

Jonny White/Alamy Stock Photo

Diversity of Canadian culture **Canadian culture is often characterized as multicultural, encompassing influences from a wide range of nationalities as well as from its own Indigenous culture.**

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

1. How is behaviour different from mental processes? How are they the same?

2. What are the three levels of analysis in psychology?

What Do You Think? • What would be the focus of each of the four goals of psychology when studying the use of Facebook and other social media? How would the questions and actions of a psychologist who seeks to describe social media use differ from those of someone who wants to limit children's and adolescents' use levels, for example?

Psychology's Roots in Philosophy

LEARNING OBJECTIVE 2

Describe the influences of early myths, rituals, and ancient Greek philosophies on psychology.

Historically, humans have attempted to explain inexplicable events in their natural environments through rituals and *myths*. Myths are stories of forgotten origin that seek to explain or rationalize the fundamental mysteries of life that are universal—that is, common to all cultures. For example, myths seek to explain topics such as the reason for earthquakes, why crops are poor or plentiful, how humans came to be, and so on. Rituals are solemn ceremonies that are related to myths and involve sacred or customary ways of celebrating important religious or social occasions in a given culture (see photo). Rituals therefore reflect an innate human need to understand and make sense of people and the natural world. In fact, according to some theorists, science is somewhat similar to mythology in that science represents our attempt to describe, explain, predict, and control our reality (Schrempp, 2019).

The Babylonians, Buddhists, and others focused on supernatural, life-giving forces, and generated early belief systems regarding the origins of the universe and contributed to the intellectual curiosity and quest for knowledge. But the intellectual history of psychology starts with the history of Greek philosophy, because unlike other important world philosophies, the Greeks had a recorded language (Guthrie & Warren, 2013).

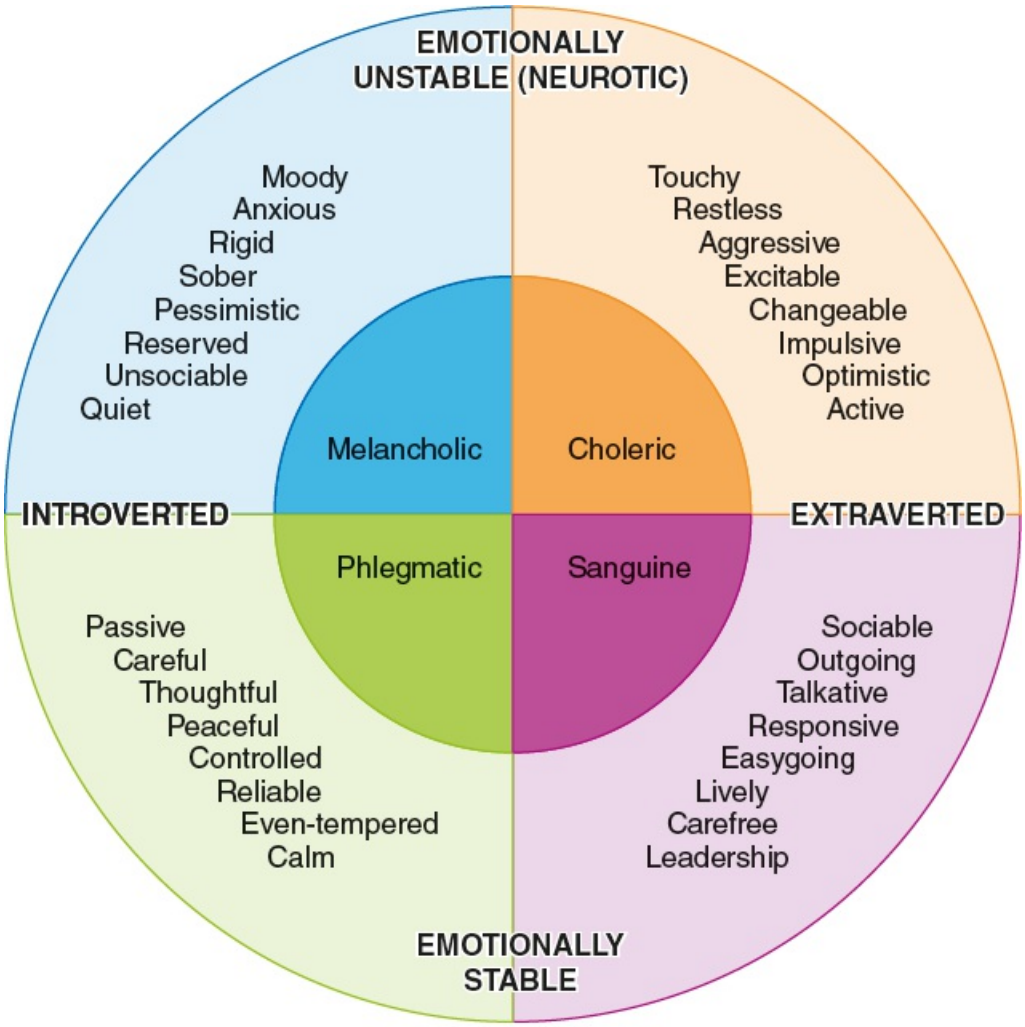
THE CANADIAN PRESS/Chad Hipolito

Rituals Many ceremonies and celebrations are developed to better understand the natural and human world. Here, on National Indigenous Peoples Day, in Vancouver BC, a welcome dance is performed at the Vancouver School District.

Although they did not consistently rely on empirical methods to examine questions, the early Greek philosophers in the fourth and fifth centuries B.C.E. moved beyond myths and rituals. Instead, they tried to find ways to determine the nature of reality and the limitations of human awareness. To accomplish these difficult goals, they engaged in open, critical discussions of each other's ideas. *Philosophy* is defined as the study of knowledge, reality, and the nature and meaning of life. Among many other questions, the ancient philosophers such as Plato, Aristotle, and Hippocrates queried how the human mind

worked, how the human body related to the mind, and whether knowledge was inborn or had to be learned from experience (Brennan & Houde, 2017). In addition, the Greek philosophers developed a method of introducing problems and then questioning proposed solutions that is at the core of modern scientific methods, which we will discuss in greater detail in Chapter 2. Greek philosophers also emphasized that theories, ideas about the way things work, are never final, but rather are always capable of improvement. Psychologists still take this view.

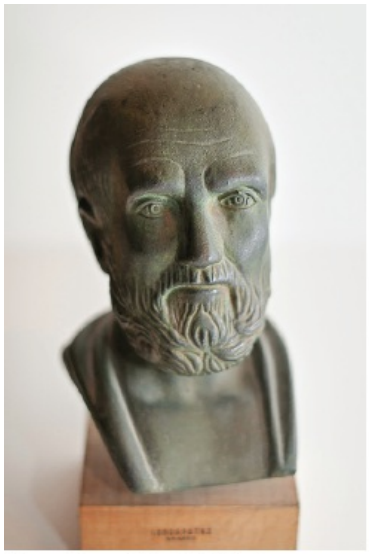
The Greeks recognized that mental and physical health were integratred and that the mind and body were connected. For example, Hippocrates (ca. 460–377 B.C.E.), a Greek physician recognized as the "Father of Medicine," believed that disease had a physical and rational explanation and was not caused by evil spirits or as a punishment from the gods. Instead, he believed that an individual's physical and psychological health was influenced by an excess or a lack of one or more of four bodily *humours*. He believed that the balance of these four bodily fluids (blood, phlegm, yellow bile, and black bile) collectively determined a person's personality and character, and predicted the individual's well-being and responses to environmental events **Figure 1.1**. Although Hippocrates' medical theory of *humourism* was wrong, he was the first to recognize the importance of good food, fresh air, and rest, and he accurately diagnosed the symptoms for pneumonia and epilepsy. He also correctly identified the brain as the organ of mental life, and argued that thoughts, ideas, and feelings originated in the brain and not in the heart—as was commonly believed at the time. Hippocrates tested his theories with direct observation and experimentation. Because of such early efforts, academic study became firmly rooted in detailed scientific methods (Kalachanis & Michailidis, 2015).



Source: Women Indigenous Health

FIGURE 1.1 The four humours and temperament Hippocrates believed that good physical and mental health relied on the balance of the human body's four humours. Centuries later, Roman physician and philosopher, Galen of Pergamon, associated Hippocrates' humours with characteristics of temperament (in parentheses): blood (sanguine), phelgm (phlegmatic), yellow bille (choleric), and black bile (melancholic).

Another Greek philosopher, Plato (ca. 427–347 B.C.E.), believed that the human mind was imprinted with all relevant knowledge and that this knowledge was innate—that is, inborn or existing within a person from birth. Plato believed that the healthy mind represented a balance among intellect, emotion, and base desires and appetites. An overreliance on any one area resulted in an unhealthy imbalance. For example, greed and avarice might be a result of desires and appetites governing behaviour. However, Plato believed that a healthy psyche provided opportunity for reasoning to uncover the core ideas deeply embedded in every human mind.



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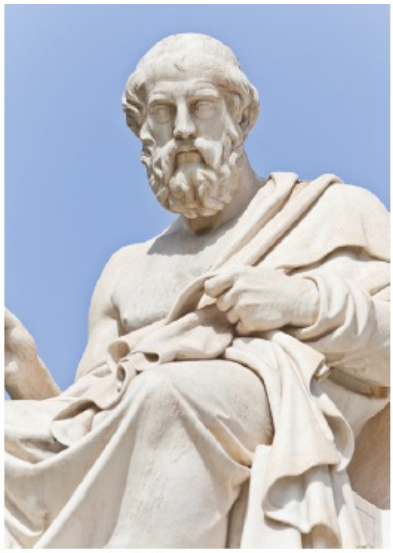

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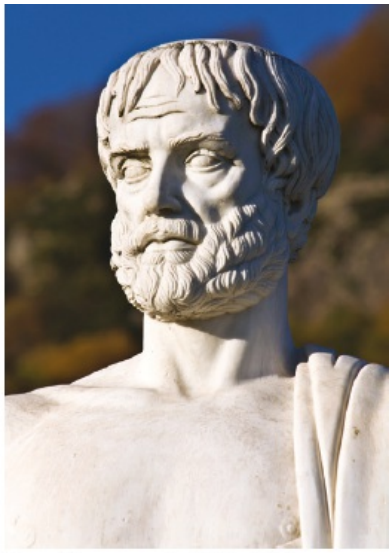


PanosKarapanagiotis/Getty Images

The prominent three **Much of the basis of Western philosophy rests on the thoughts and ideas of three Greek philosophers: Hippocrates, Plato, and Aristotle.**

Similarly, Aristotle (ca. 384–322 B.C.E.), a student of Plato's, and one of the most famous thinkers of the Greek period, made key contributions to the foundations of psychology (see photos). Aristotle's writings represent some of the first important theories about many of the topics discussed throughout this book, such as sensations, dreams, sleep, and learning (Engelsted, 2017). Aristotle was one of the first to promote empirical, or testable, investigations of the natural world. He looked inward at sensory experiences and also scrutinized his environment, searching for the basic purpose of all objects and creatures. In his studies, he formed ideas about how living things are hierarchically categorized, concluding—centuries before Charles Darwin—that humans are closely related to animals.

Psychology's Roots in Physiology and Psychophysics

As Europe emerged from the Dark Ages, the philosophies of the ancient Greek scientists and philosophers were rediscovered approximately 2000 years after they lived and re-emerged to influence European thinkers throughout the Renaissance. Although mysticism declined as a form of explanation for human nature, there remained great confusion and disagreement regarding human motives and origins.

ilbusca/Getty Images

René Descartes First of the modern philosophers.

In the centuries both during and after the Renaissance through to Associationism, European society underwent a scientific revolution. A spiritual worldview, which had dominated for several centuries, was increasingly replaced by a view of the world based on mathematics and mechanics. By the 1600s, modern science began to thrive and over time both the universe and human beings were viewed as machines subject to fixed natural laws. The dominant view was that the brain controlled the body by moving fluids from one area to another. The roles of magic and mysticism in science essentially disappeared (Leahey, 2017).

During this time, Francis Bacon (1561–1626), an English philosopher, scientist, and statesman who was fascinated by the human mind, became a prominent figure in scientific methodology and natural philosophy. He is widely regarded as the creator of *empiricism*: the view that all knowledge originates in experience. He established and popularized the scientific method, gathering data, analyzing data, and performing experiments.

Like Socrates and Plato, René Descartes (1596–1650; see illustration), the first of the modern philosophers and an early scientist, viewed all truths as ultimately linked and believed that the meaning of the natural world could be understood through science and mathematics. Descartes contemplated the nature of existence and dualism of the mind and body, believing the mind to be distinct from the body. He identified the point of contact between the two as the pineal gland, and he believed that the mind (which he viewed as synonymous with the soul) would survive the death of the body and was therefore the "province of God" (Pickren & Rutherford, 2010, p. 5).

The theories of both Bacon and Descartes influenced the work of British philosopher John Locke (1632–1704), who believed that we learn by our experiences. He notably argued that the mind at birth is a *tabula rasa*—a blank slate—"a white paper, void of all characters, without any ideas" (Locke, 1689), waiting for experience to imprint knowledge. That is, Locke thought that at birth the human mind has no innate ideas but instead acquires all knowledge through experience.

While philosophers debated the nature of the human experience, other researchers believed that important insights about the brain and body could be understood by combining empirically established facts with philosophical thinking. The area of psychophysics, pioneered by prominent physiologist Johannes Müller (1801–1858), maintained that researchers needed to study the relationship between physical stimuli and their psychological effects—that is, the sensations and perceptions they affect. Psychophysics examined questions such as how much sound or light needs to be present to be detected, and how much sound or light must be added to an initial signal before we notice the change. Herman von Helmholtz (1821–1894), a student of Müller's, was the first to measure the speed of a nerve impulse and determined that nerve impulses occur over time rather than instantaneously. This finding led to the understanding that thought and movement are linked, but are not the same thing. The work of von Helmholtz contributed to the foundation of modern physiological psychology and neuroscience (Patton, 2018).

Gustav Fechner (1801–1887) was a German philosopher and physicist who is considered to be one of the founders of experimental psychology. He published a book summarizing this work in 1860, called *Elements of Psychophysics*. In the book, Fechner (1860) lays out many of the methods and study techniques that would come to be used in the emerging field of psychology. His evidence of the relationship between physical and mental events demonstrated that psychology had the potential to become a quantified science. While Fechner completed his manuscript, a physiologist, Wilhelm Wundt (1832–1920), came to work in the laboratory with Helmholtz. As we will see, these two events contributed to the foundation of psychology as a discipline.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

3. What do the earliest myths have in common with today's scientific studies?

4. Greek philosophers who believed reasoning would uncover ideals or core ideas were focused on which aspect of psychology?

5. How did the Greek philosopher Hippocrates explain mental processes and behaviour? How did Hippocrates' research methods influence today's study of psychology?

What Do You Think? • What advantages do you think a scientific approach has for explaining behaviour and mental processes compared with a supernatural approach?

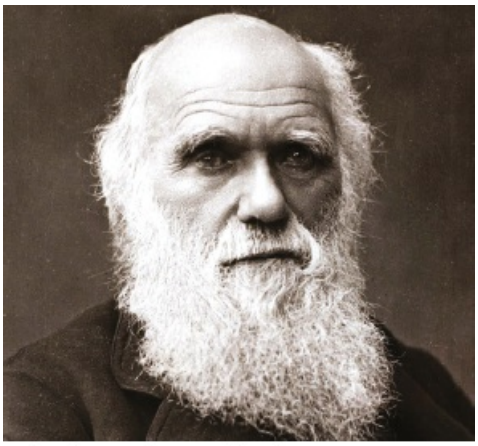
The Early Days of Psychology

LEARNING OBJECTIVE 3

Name important early psychologists and describe their major theories and research

methods.

In the latter part of the nineteenth century, Charles Darwin (1809–1882; see photo), in his book *On the Origin of Species* (1859, 1872), proposed the theory of evolution, making the radical suggestion that all life on Earth was related and that human beings were just one outcome of many variations from a common ancestral point. Darwin also suggested natural selection as the mechanism through which some variations survive over the years while other variations fall out of existence. *Natural selection* proposes that chance variations are passed down from parent to offspring, and that some of these variations are *adaptive*—better suited to an organism's environment. These adaptive variations help the organism to survive and reproduce in their specific environment. On the other hand, less-adaptive variations reduce the organism's ability to survive.



Bob Thomas/Popperfoto/Getty Images

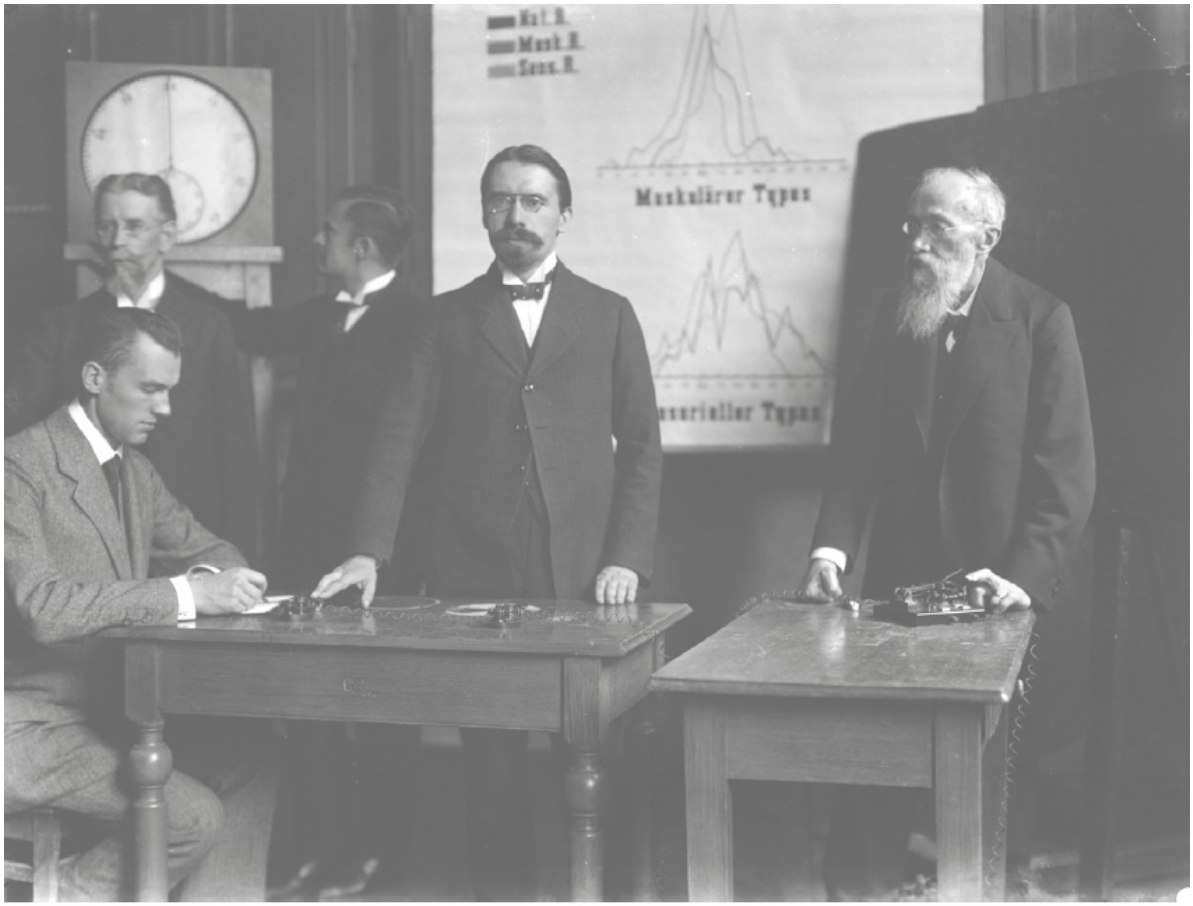
Charles Darwin (1809–1882) The theories by the English naturalist about human evolution shifted scientific attention toward human origins and behaviour.

The Founding of Psychology

In this atmosphere of heightened interest in the mind–body duality debate and the nature–nurture debate among philosophers, physicians, and scientists, psychology emerged as a distinct scientific field of investigation. As we have observed, prior to the late nineteenth century, psychology was virtually indistinguishable from the study of philosophy. In 1879, however, the physiologist Wilhelm Wundt (1832–1920) opened a laboratory in Leipzig, Germany, dedicated exclusively to the study of psychology (see photo). As a natural scientist, Wundt believed that the study of mind and behaviour ought to be conducted using the experimental methods of other sciences such as chemistry and physics, so he established a program that trained students to perform empirically driven experiments in psychology. Psychology's emphasis on rigorous, scientific experimentation continues to this day, as we'll see in Chapter 2.

Wundt exposed research participants to simple, standardized, repeatable situations and then asked them to make observations, an approach similar to the one used in the study of physiology. One of Wundt's most famous experiments involved a clock and pendulum. Wundt found that when determining the exact location of the pendulum at a specific time, his observations were always off by 1/10 of a second. He believed that he had found

evidence that humans have a limited attention capacity and that it requires 1/10 of a second to shift focus from one object to another (Wundt, 1883).



Archives of the History of American Psychology, The Center for the History of Psychology, The University of Akron

The father of experimental psychology Wilhelm Wundt (far right) works with colleagues in his laboratory at the University of Leipzig, one of the first laboratories devoted exclusively to psychological research.

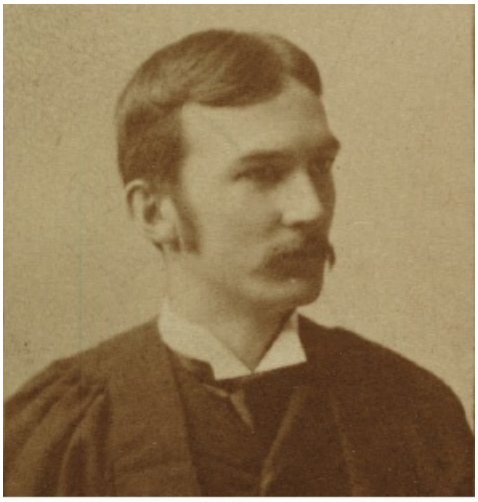
Wundt studied the content and processes of **consciousness**, the awareness of immediate behaviours and mental processes. Wundt hoped to emulate the experimental methods observed in the natural sciences and believed that consciousness could be broken into basic elements, "atoms" of the mind, much as chemistry had identified chemical elements according to their atomic numbers, electron configuration, and so on. In his laboratory, he was particularly interested in studying the idea of *will* and how it influences what individuals choose to attend to in their environments. He believed that the will organized the mind's content into higher-level, more complex thought processes. He further believed that much of behaviour is motivated and that attention is focused for an explicit purpose. For example, he believed that behaviours could be altered to adjust for changing circumstance. To distinguish between automatic and controlled actions and perceptions, Wundt developed a psychological paradigm he called **voluntarism**. Voluntarism refers to voluntary and willful acts of decision in human behaviour. Later, Wundt also went on to form theories about emotion and the importance of historical and social forces in human behaviour. His ideas about cultural psychology are in fact appreciated today for their early

recognition that an individual's social context must also be taken into account to fully explain his mental processes and behaviour (Araujo, 2016).

consciousness personal awareness of ongoing mental processes, behaviours, and environmental events.

voluntarism a theory in which will is regarded as the ultimate agency in human behaviour; belief that much of behaviour is motivated and that attention is focused for an explicit purpose.

Beyond his own direct contributions to the new field of psychology, Wundt also served as teacher and mentor to many students who went on to shape the future of psychology. G. Stanley Hall was one of the first Americans to visit Wundt's lab. Hall would go on to found one of the first American experimental psychology laboratories at Johns Hopkins University in 1883. He also launched America's first psychology journal (in 1887), and was the driving force behind, and first president of, the American Psychological Association. James McKeen Cattell was the first American to earn his doctorate with Wundt, and would go on to establish psychology labs at the University of Pennsylvania and Columbia University. Princeton graduate, James Mark Baldwin, trained for a year in Germany where he became enamoured of the "new psychology" based on the ideas of Wundt and Fechner. He later moved to Canada and established the first laboratory of experimental psychology at the University of Toronto (see photo). Directly and indirectly, Wundt did much to shape the emerging science of psychology.



University of Toronto Archives

James Mark Baldwin (1861–1934) Shown here in 1890 while at the University of Toronto, Baldwin established the first psychology lab in the British Empire in Toronto in 1890 (Pantalony, 1997).

Structuralism: Looking for the Components of Consciousness

Edward Titchener (1867–1927), an Englishman, emigrated to the United States in 1892 and expanded upon Wundt's approach, forming a theoretical paradigm called **structuralism** at Cornell University. Titchener's goal was to uncover the structure, or basic

elements, of the conscious mind, much like looking at the parts that make up a car engine or bicycle or the individual bricks in a Lego sculpture, and to then determine how these elements were related. Titchener and other researchers attempted to break mental processes down into their most basic fundamental components, such as sensations or feelings. Structuralists then endeavoured to identify the laws governing the relationships between these elements and to ascertain how these elements interacted with the mind and body.

> **structuralism** a philosophical approach that studies the structure of conscious experience.

To study the conscious mind, the structuralists relied heavily on a method originated by Wundt, called **introspection**, which literally means "looking inward." Introspection involved the careful reflective and systematic observation of the details of mental processes and how they expand simple thoughts into complex ideas. It required the self-observation and self-reflection of individuals' own experiences. If shown a house made of Lego, for example, an introspecting structuralist would describe the smooth, shiny texture of each brick, the colour of the brick, the tiny gap between it and the adjoining bricks, and so forth.

> **introspection** a method of psychological study involving careful evaluation of mental processes and how simple thoughts expand into complex ideas.

Introspection proved unreliable (Leisti & Häkkinen, 2016) because regardless of how systematic an observation was, structuralists were not always able to agree. In these instances there was no real way to resolve differences. Moreover, it was argued that reflection on a feeling or experience changes the feeling or experience, so critics claimed that no real act of introspection could occur.

Toward the end of the 1800s, arguments began to emerge against the use of introspection as an experimental technique. Skeptics pointed out that scientists using introspection often arrived at diverse findings, depending on who was using the technique and what they were trying to find. The school of structuralism also came under attack for its failure to incorporate the study of animals and to examine issues of abnormal behaviour.

The major concern many psychologists had with structuralism, however, was its emphasis on gathering knowledge for its own sake without any further agendas such as a desire to apply our knowledge of the mind in practical ways. Recall the four goals of psychology discussed earlier. The goal of the structuralists was to use introspection to *describe* observable mental processes rather than to *explain* the mechanisms underlying consciousness or to try to *control* such mechanisms. They believed that speculation about unobservable events had no place in the scientific study of psychology. Ultimately, even Titchener himself acknowledged the need to understand the purpose of human thought and behaviour rather than to merely describe it.

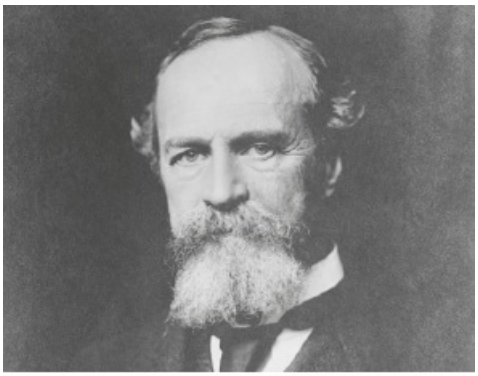
Although many of structuralism's principles did not survive, its propositions that psychologists should focus largely on observable events and that scientific study should focus on simple elements as building blocks of complex experience have lived on in certain

modern schools of thought.

Functionalism: Toward the Practical Application of Psychology

William James (1842–1910), brother to well-known author Henry James and a student of Helmholtz, was a philosopher, physician, and psychologist (see photo). James wrote one of the first important psychology texts, *Principles of Psychology* (1890). He was instrumental in shifting attention away from the structure of mental content to the purposes and functions of our mental processes. James admired the work of Darwin and argued that human thoughts, perceptions, and emotions have helped humans to adapt and therefore to survive, and that it was therefore important to understand how consciousness functions. He reasoned that consciousness had to serve an important biological function because it was a trait in humans that had been naturally selected, and he argued that psychologists needed to determine what those functions were (Hoffman & Thelen, 2010). Thus, James's approach was called **functionalism**. Functionalism was based on the belief that scientists should examine the function or purpose of consciousness, rather than simply focusing on its structure. To use our earlier analogy, functionalists were less interested in describing the parts of a car engine or bicycle, and more interested in what the engine or bicycle could do under a variety of conditions.

> **functionalism** a philosophical approach that considers how mental processes function to adapt to changing environments.



Bettmann/Getty Images

William James (1842–1910) The influential psychologist and philosopher investigated the purposes and functions of our mental processes. His book, *The Principles of Psychology*, took 12 years to write and was 1200 pages in length.

James viewed consciousness as an ever-changing stream of mental events rather than the more or less static set of components that the structuralists were seeking. For this reason, James and his colleagues were also interested in understanding how the mind adapted and functioned in a changing environment.

Functionalism did not rely primarily on a single research method, such as introspection. Instead, it used a variety of empirical methods that focused on the causes and consequences of behaviour. The functional approach also highlighted differences among individuals rather than identifying only those characteristics that they shared. And unlike

structuralism, functionalism emphasized the need for research to include animals, children, and persons with mental disorders in order to understand both normal and abnormal psychological functioning (Wertheimer, 2012). (See photo.)

JGI/Tom Grill/Tetra images/Getty Images

Mother-child interaction **Functionalists saw the value in studying children to better understand human functioning.**

An example of research demonstrating the shift from structuralism to functionalism was apparent in an early experiment on how humans locate sound. Participants in the experiment were asked to point to the location of a sound (Angell, 1903). A structuralist would have asked each participant to provide an introspective report of their conscious experience of the sound. Functionalists, however, were more concerned with issues like how accurately participants could point in the direction in which the sound was physically located.

Although it never really became a formal school of psychology, functionalism helped to focus psychologists' attention on what the mind can and does accomplish. Spurred by the emphasis of functionalists on providing applicable and concrete information, psychology began to tackle socially relevant topics. Researchers William Lowe Bryan and Noble Harter (1897), for example, performed a famous investigation regarding how quickly telegraph operators could learn necessary typing skills. Their findings were used to improve training for railroad telegraphers, and the study is now widely regarded as one of the first to have a significant social and commercial impact. Functionalism also marked the beginning of exploration into socially important issues, such as emotional processing (Laird & Lacasse, 2014) and learning and education, in fact, *educational psychology* remains a significant area of research in the field today (Wittrock & Farley, 2017).

Gestalt Psychology: More than Putting Together the Building Blocks

While opponents of structuralism in North America were raising concerns that structuralism did not examine the uses of consciousness, Max Wertheimer (1880–1943)

and other psychologists in Germany were questioning the structuralist idea that consciousness could be reduced to pieces or to basic mental elements. **Gestalt psychology** is based on the idea that we have inborn tendencies to impose structure on what we see, and these tendencies cause us to perceive things as broad "perceptual units" rather than as individual sensations. Indeed, the word *Gestalt* is of German origin, meaning "whole" or "form." The Gestalt school rejected the molecularism of the structuralists and instead subscribed to the idea that "the whole is greater than the sum of its parts." Researchers using this approach studied illusions and errors in perception, memory, and judgment to identify why subjective experience differed from objective reality.

> **Gestalt psychology** the field of psychology arguing that we have inborn tendencies to structure what we see in particular ways and to structure our perceptions into broad perceptual units.

For example, when you look at a computer screen you see complete pictures, when in fact each picture is made up of thousands of small dots, called *pixels*. If you get close enough to the screen, you can see the picture break down, but our brains still favour integrating those dots into a cohesive picture or whole. Wertheimer and colleagues believed that the mind imposed organization on perceptions and that this organization of a holistic perception prevented people from seeing what they were being shown by the experimenter. This phenomenon can be observed in **Figure 1.2**, where a visual illusion is created when the visual system tries to make sense of what it sees. The brain assumes that the missing pieces of the circle are caused because a square shape is lying on top of the circles and occluding pieces of them. So, rather than experiencing four incomplete circles, we experience a floating square. Similar findings have been gathered regarding our tendency to group eyes, noses, and mouths into recognizable human faces. Children 3 months of age or younger show a preference for human faces, but only when the component parts of faces are arranged correctly in a facial orientation (Valentine, Lewis, & Hills, 2016).

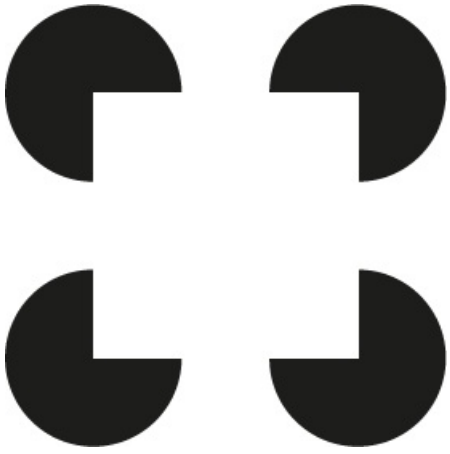


FIGURE 1.2 Kanzia illusion This visual illusion causes the visual system to create a floating square that does not actually exist. (To prove this to yourself, cover all four circles and you will see the square disappear.)

Gestaltists developed over 100 perceptual principles to describe how the brain and sensory systems perceive environmental stimuli. Some of the Gestalt laws will be discussed in

Chapter 5. Gestaltists also viewed learning as tied to perception—the recognition and identification of stimuli that come through our senses. They believed that problem solving occurs when a person develops a sudden and complete insight into a solution—indeed, they believed that problems remain in an unsolved state until such points of insight occur.

Together with the functionalists, the Gestalt school helped guide psychology away from the study of individual elements and toward a broader view of the human mind and functioning. Many of its concepts and the importance of the study of perception are still present in modern psychology.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

6. What is introspection, and which early school of psychologists relied most heavily upon it?

7. What is the main difference in approach between functionalism and structuralism?

8. What did the Gestalt psychologists study?

What Do You Think? • Which early school of psychology most closely resembles the way you view the human mind? Why?

Twentieth-Century Approaches

LEARNING OBJECTIVE 4

Summarize the major principles of the psychoanalytical, behaviourist, humanistic, cognitive, and neuroscience approaches to psychology.

From the late 1800s into the twentieth century, psychology continued to grow as a science. In the years leading up to World War I and through World War II, there was tremendous growth in the field of psychology. The number of psychologists rapidly expanded, and popular interest in psychology grew.

As more people became interested in the field, perspectives toward behaviour and mental processes continued to emerge. Several twentieth-century schools of thought had major influence on the field, including the psychodynamic approach, the behaviourist approach, the humanistic approach, the cognitive approach, and the sociobiological approach. Next we'll explore the defining features of each of these approaches.

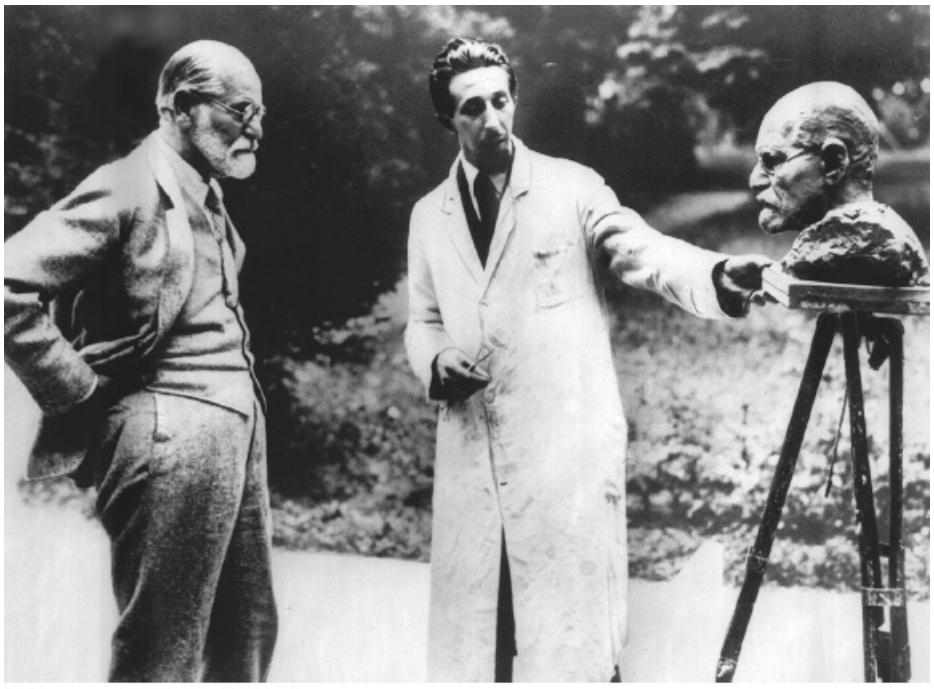
Psychoanalysis: Psychology of the Unconscious

Wundt, Titchener, and the structuralists, James and the functionalists, and the Gestaltists held very different views about how the mind is structured and how it should be studied.

But they were all alike in one way: they all focused on consciousness, behaviours, and mental processes of which we are aware. And, as you will see in Chapter 6, their early endeavours into the conscious experience remain an area of considerable study in psychology today. Other theorists, however, focused on mental processes of which we are unaware, those that happen in the **unconscious** mind.

> **unconscious** hypothesized repository of thoughts, feelings, and sensations outside human awareness, thought in some theories to have a strong bearing on human behaviour.

Sigmund Freud (1856–1939), a Viennese neurologist, suggested that many of our thoughts and feelings exist beyond the realm of awareness, in the unconscious (see photo). Freud described the conscious mind as being only the tip of the intellectual and perceptual iceberg; he believed the unconscious mind existed well below the surface of conscious awareness, but nevertheless exerted enormous influence on behaviour. Freud did not conduct experimental studies of laboratory participants; instead he built his theory on information from patients he saw in his medical practice who were coping with irrational fears, obsessions, and anxieties. Freud was particularly interested in patients who had a condition that was then known as *hysteria*. These patients, who were most often women, suffered a transient loss of perceptual, cognitive, or motor function without any known physical cause, causing blindness, paralysis, amnesia, or other catastrophic losses. Freud believed that in most cases, the patients' symptoms could be traced to toxic events from their childhoods. He was persuaded that the impact of these "lost" memories indicated the presence of an unconscious mind.



AP Images/Wide World Photos

Eye to eye Sigmund Freud, founder of psychoanalytic theory, examines a sculptured bust of himself at his village home in 1931.

Based on his detailed observations of these people's cases, Freud became convinced that the root cause for many of his patients' maladies was mental and not physical. He came to believe that the mind is a complex interaction of the thoughts and memories that exist at different levels of awareness, some conscious and some unconscious. He viewed psychological conflict as largely due to disturbances existing at an unconscious level and then reaching awareness. We will discuss these levels of awareness and consciousness further in Chapter 12. Freud's theory was developed over decades and is called **psychoanalytic theory**.

> **psychoanalytic theory** psychological theory that human mental processes are influenced by the competition between unconscious forces to come into awareness.

Freud further believed that childhood experiences help set the stage for later psychological functioning by contributing to effective or ineffective interactions among conscious and unconscious forces. According to Freud, certain developmental milestones must be achieved successfully in order for a person to achieve emotional adjustment. He also was interested in how children unconsciously adopt social and moral norms from their parents and, in turn, develop a conscious awareness of what constitutes acceptable and unacceptable expressions of their internal desires. Freud suggested that these conscious standards lead to unavoidable tensions between our unconscious primal needs and our conscious social or moral restraints. According to Freud, the back-and-forth tension within and between the conscious and unconscious mind is what shapes personality, helps produce abnormal behaviours in some cases, and governs virtually all behaviour (Smith, 2013). In fact, Freud and his followers saw the conscious mind as a thin mask over a deep unconscious mental world, a world that contains impulses and urges that cannot be expressed freely given the constraints of a person's social environment.

As we will see later in the textbook, psychoanalytic notions typically have not held up well when subjected to rigorous scientific study. For evidence, Freud relied on anecdotes and case histories of remarkable changes in his patients. Researchers have not been able to find much support for his claims when they test them with larger groups of people (Eysenck & Wilson, 2013; Kline, 2013). The lack of research support, as well as philosophical differences, prevented many of his contemporaries from accepting Freud's theories. William James, the functionalist, for example, rejected the psychoanalytic notion of the unconscious. To him, conscious ideas were not a product of underlying machinery (i.e., the unconscious); instead, he believed that what was observed in the conscious mind was the complete experience.

Nevertheless, to this day, psychoanalysis remains an influential theory of mental functioning and personality in the field of psychology (Barratt, 2013). Clearly, Freud's theory increased the applications of psychology to many aspects of everyday life. It stirred interest in motivation, sexuality, child development, dreams, and abnormal behaviour—all topics we will discuss later in this book. Freud's use of "the talking cure" as a therapeutic technique helped lead to the creation of psychiatry and clinical psychology as influential therapeutic methods, and these methods continue to thrive.

Although many of Freud's ideas have been challenged, they certainly marked a turning point in the understanding of human nature. Psychoanalytic theory was among the first

psychological theories to provide a comprehensive view of human nature, and it helped make psychology relevant to more people (Chessick, 2014).

Behaviourism: Psychology of Adaptation

In addition to theories about the conscious and the unconscious mind, a third area of psychology, called **behaviourism**, emerged in the early part of the twentieth century. This school of thought was founded on the belief that psychology should study only behaviours that are directly observable rather than abstract mental processes.

> **behaviourism** a branch of psychological thought arguing that psychology should study only directly observable behaviours rather than abstract mental processes.

Early behaviourists tended to focus on the relationships between **stimuli**—things that trigger changes in our internal or external states—and **responses**—the ways we react to stimuli. As you'll read in more detail in Chapter 7 on Learning, the behaviourists developed a number of influential ideas about how responses produce consequences and how those consequences in turn affect an organism's future responses to stimuli.

> **stimuli** elements of the environment that trigger changes in our internal or external states.
>
> **response** the way we react to stimuli.

Behaviourism originated in North America and Russia. In North America, animal research was growing in popularity, while in Russia, Ivan Pavlov's (1849–1936) discovery of a phenomenon that came to be called *conditioning* linked various animal behaviours to events in the animals' environments (Bauer, 1952; Mills, 2012). Pavlov, a physiologist, observed that dogs salivated when his lab assistants brought them food. Later, he noticed that the dogs also salivated when the lab assistants appeared—even when they brought no food. The dogs had been *conditioned*—that is, they had learned—to associate one stimulus (food) with another (lab assistants) and to respond in the same way to both. You will read more about Pavlov's work in Chapter 7. Such successful studies of non-human behaviour called into question the methods being used to investigate human behaviour. Even though animals could not engage in introspection, scientists were learning a great deal by observing their behaviour.

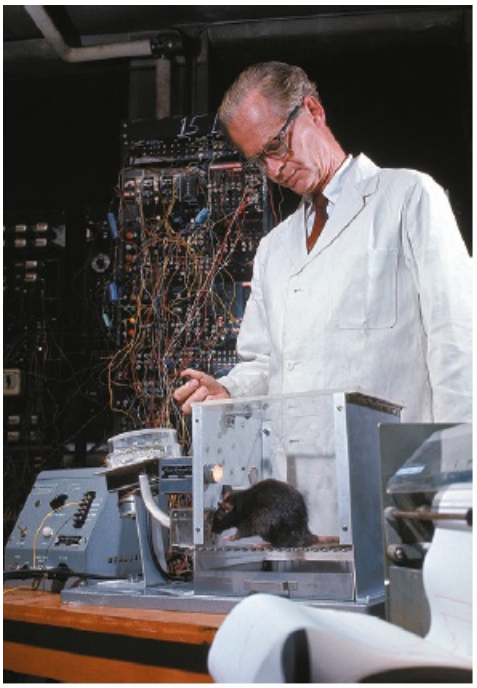
Jonathan Hayward/THE CANADIAN PRESS

Olympic gold! Does Dara Howell train for love of the sport, for the medals, for the camaraderie, or for endorsement contracts? It is hard to say what motivates Dara Howell, but behaviourists argue that something reinforces every athlete.

Edward Thorndike (1874–1949), who was technically a functionalist, helped transition the field of psychology toward behaviourism by proposing that animal findings could help explain human behaviour. As behaviourism proved increasingly fruitful and popular, tensions grew between investigators who used introspection and those who relied on observation.

John Watson (1878–1958) is generally credited with pioneering the school of behaviourism. He agreed with Thorndike that animals could be useful in guiding our understanding of human psychology, and he sharply disagreed with psychoanalysis and with the notion of unobservable mental processes as appropriate approaches to studying the mind and behaviour. As we'll discuss in Chapter 7, he was able to extend Pavlov's animal work to young children, and he essentially launched modern psychological theory by demonstrating that children could be conditioned by researchers to fear various objects and situations.

B.F. Skinner (1904–1990), who emerged as the leading behaviourist after World War II, helped expand behaviourism's perspective by acknowledging that internal, mental processes may indeed be at work in some situations, such as when an animal runs to get food (see photo). But even here, Skinner argued, empirical—observable—information should be gathered first, and then theories about causation could be formulated from that. That is, even when behaviourists acknowledged that internal mental processes were probably at work, they held that their primary job was to describe empirical phenomena, not to explain them (Schultz & Schultz, 2012). For example, when observing the behaviour of a monkey who is attempting to obtain food, a behaviourist might describe how the animal distinguishes a particular food from other stimuli, how it approaches the food, and what steps it takes to obtain it—observations meant to reveal how particular responses come to be associated with the food stimulus.



Nina Leen/Time & Life Pictures/Getty Images

The box! B.F. Skinner developed the "Skinner box" to help him investigate how consequences reinforce behaviour. Here he uses the box to train a rat to press a lever for a food reward.

An idea central to behaviourism is that the consequence resulting from a particular behaviour serves to either increase or decrease the likelihood that an organism will perform that same behaviour again in the future. If the consequence of a given behaviour is rewarding, the consequence is regarded as a **reinforcement**, and the organism will be more likely to repeat the behaviour in the future. A behaviour is *positively* reinforced when it brings about a desired outcome (such as food or money), and *negatively* reinforced when it helps an organism avoid an undesirable outcome (such as an electrical shock or loud noise). For example, procrastination may be negatively reinforcing to the extent that it helps people avoid the pain of actually sitting down to study. Remember, if a particular behaviour is reinforced, either positively or negatively, we are more likely to repeat the behaviour later (see photo).

reinforcement a learning process that increases the likelihood a given response will be repeated.

The term *negative reinforcement* is sometimes confused with **punishment**, but the latter is really a very different factor in behaviour. Unlike negative reinforcements, *punishments* render behaviours less likely to be repeated. Denying a child his dessert for not eating his broccoli is a punishment. However, if the parent was nagging the child to eat broccoli and then stops when the child eats it, the child has been negatively reinforced—that is, the unpleasant nagging has stopped; therefore the child has been negatively reinforced in this situation and will eat the food the parent insists in order to avoid the unpleasant nagging.

punishment an experience that produces a decrease in a particular behaviour.

The principles of behaviourism became widely used in advertising and in helping businesses address personnel problems. As behaviourism grew in popularity, its principles were applied to numerous industries as well as to courts, schools, and even the military. During this period, researchers also placed great emphasis on the development of controlled scientific methods that might establish psychology once and for all as a true science. Given the appeal of its objective and controlled methods of investigation, behaviourism reached considerable prominence in the academic field, dominating the field from the 1930s for over twenty years. Behaviourism continues to have a strong influence on psychology today. Indeed, most of today's experimental studies continue to adhere to rigorous research standards similar to those devised by behaviourists.

Michael Haslam, Adriana HernandezAguilar, Victoria Ling, Susana Carvalho, Ignacio de la Torre et al. *Nature 460*, 339-344 (16 July 2009).

The real teachers **These young Bonobo chimpanzees, along with other animals, learn behaviours in their natural environments where their parents and other important figures inadvertently apply reinforcements and punishments.**

Behaviourism was not embraced by all, however. Some psychologists criticized John Watson and other prominent behaviourists for popularizing and, in their view, cheapening psychology. In 1929, for example, psychologist Joseph Jastrow wrote that behaviourism's portrayal in popular magazines and newspapers undermined psychology's role as a valid science. Many other psychologists also raised questions about the merits of behaviourism; some of their concerns are raised below.

Moreover, the behaviourists themselves began to disagree with each other and to divide into competing schools of thought. In the 1960s, for example, the Mundare, Alberta-born psychologist Albert Bandura (1925–) demonstrated that children often seem to learn not by conditioning or clear rewards and punishments, but by *social observation*, or *modelling*. Bandura and other psychologists also showed that people could learn without any

apparent change in their overt behaviour, a phenomenon that suggested individual changes might reflect some kind of internal representations and mental processes after all. With these and related developments, pure behaviourism (that is, behaviourism with no attention to mental processes, such as beliefs or thoughts) began to lose some of its influence. In fact, a new field, *cognitive behaviourism*, gained ground; this new approach combined conditioning and cognition to better explain behaviour (Greenwood, 2015).

Bettmann/Contributor/Getty Images

Humanistic pioneer Carl Rogers was the founder of client-centred therapy, which promotes an equal relationship between therapists and clients and helps clients to achieve their full potential.

Humanistic Psychology: A New Direction

By the 1950s and 1960s, psychoanalytic and behaviourist theories were at opposite ends of the psychology spectrum, one focusing exclusively on mental processes and the other exclusively on behaviour. The 1960s were a particularly troubled time socially and economically in North America. It was also a time when heated debates took place regarding the relationship between people and authority figures and when questions were raised about essential human rights. In this atmosphere, **humanistic psychology** emerged as an alternative theory that took an optimistic view of human nature and sought to give greater prominence to the special and unique features of human functioning rather than to the mechanistic principles that they believed characterized psychoanalysis and behaviourism. Humanists emphasized the unique qualities of humans and acknowledged their rationality as well as their central human drive for freedom and personal, positive growth.

humanistic psychology theory of psychology that sought to give greater prominence to special and unique features of human functioning.

Founding humanistic theorists Carl Rogers (1902–1987; see photo) and Abraham Maslow (1908–1970) rejected the approach of behaviourists. They felt that behaviourists looked at humans just as they looked at animals—that is, as machines that could be predicted and controlled—but giving little or no weight to consciousness and other distinctly human characteristics. Humanism, in contrast, focused on the potential of individuals and highlighted each person's subjectivity, consciousness, free will, and other special human qualities. According to humanistic psychologists, all people have the potential for creativity,

positive outlook, and the pursuit of higher values. They claimed that if we can fulfill our full potential, we will inevitably lead a positive life of psychological growth (Elkins, 2012; Kirschenbaum, 2011).

Maslow, in fact, proposed that each of us has a basic, broad motive to fulfill our special potential as human beings, which he called the drive for *self-actualization* (see photo). He suggested that anyone who achieved this broad motive would indeed lead a positive and fulfilling life. Maslow's hierarchy of human needs is examined further in Chapter 11.

Bettmann/Getty Images

Abraham Maslow **Maslow prioritized our numerous needs and believed that we must satisfy basic physiological and safety needs first. Only then can we progress up the hierarchy to satisfy other needs and achieve self-actualization.**

The humanists developed innovative treatments for psychological adjustment issues and disorders, many of which are frequently used today. Carl Rogers developed a humanistic alternative to the psychoanalytic approach to psychotherapy, which he called **client-centred therapy**. According to Rogers, therapists should respect their clients as equals. He argued that the therapist should establish a trusting and warm relationship with the client by "mirroring" feelings and conveying unconditional support and positive regard for the client. This very human approach to therapy played an important role in the establishment of the fields of clinical and counselling psychology after World War II. We will discuss therapy in greater detail in Chapter 16.

client-centred therapy an approach to therapy founded by Carl Rogers, based on the notion that the client is an equal and that positive gains are made by mirroring clients' thoughts and feelings in an atmosphere of unconditional positive regard.

The humanists believed that behaviourism was too limited in their focus on the objective realm, and that psychoanalysis failed to acknowledge the free will and autonomy of individuals. The goal of humanists, in contrast, was to jolt people from a psychological rut

and to help them realize their innate potential for growth. Although humanism did not ultimately have as great an impact on psychology as the schools of behaviourism and psychoanalysis, it sparked a greater appreciation of human consciousness and helped to establish a balance between the prevailing views of psychology. Perhaps most importantly, the movement triggered an increased interest in mental processes (Norman, 2013).

Cognitive Psychology: Revitalization of Study of the Mind

In the years after World War II, a new school of psychology emerged whose goal was to effectively measure mental processes. The famous psychologist George A. Miller (1920–2012) has recalled that period as a time when "cognition [mental process] was a dirty word because cognitive psychologists were seen as fuzzy, hand-waving, imprecise people who really never did anything that was testable" (Baars, 1986, p. 254). While serving as president of the American Psychological Association in 1960, the Canadian psychologist Donald Hebb (1904–1985) urged the psychological community to apply the rigorous experimental standards seen in behavioural studies—that is, controlled and objective methods—to the study of human thought.

In 1967, Ulric Neisser (1928–2012), a student of Miller's, published the influential text *Cognitive Psychology* in which he described *cognition* as "all the processes by which . . . . sensory input is transformed, reduced, elaborated, stored, recovered, and used" (Neisser, 1967, p. 4). Neisser went on to define **cognitive psychology** as the study of **information processing**, the means by which information is stored and operates internally. Despite its unpopular beginning, the cognitive perspective is currently the prevailing perspective in psychology.

> **cognitive psychology** the field of psychology studying mental processes as forms of information processing, or the ways in which information is stored and operated in our minds.
>
> **information processing** the means by which information is stored and operates internally.

Cognition is defined as the mental processes involved in knowing, perceiving, and remembering and includes research in areas such as decision making, problem solving, and understanding language. Many cognitive psychologists compare the human mind to a computer, likening mental processes to the mind's *software* and the human nervous system to the system's *hardware*. Early cognitive psychologists reasoned that if modifying software can control the "behaviour" of computers, identifying and modifying specific mental processes ought to control *human* behaviour. Cognitive psychology has become the dominant model of the mind.

Not surprisingly given their focus, cognitive psychologists focused their attention on the *functioning* of cognitive mechanisms rather than on their content. Cognitive researchers were able to observe the "inputs" and "outputs" of the mental system through carefully controlled experimentation, and then to theorize about the internal mechanisms that must underlie such mental functioning.

Cognitive psychology continues to influence contemporary theory and research into

memory, perception, and consciousness, among other areas that we will discuss throughout the text. The rigorous experimental standards established by cognitive scientists continue to define current methods for studying how information is stored and manipulated by the brain across different situations. Moreover, at the core of a relatively new field called **cultural psychology** is an interest in how cognitive processing may vary across different populations due to the influences of their distinct socio-cultural environments. While cultural psychology looks to see how human thought and action might vary across cultures, **cross-cultural psychology** uses cognitive experimental methods to help distinguish mental processes that are *universal* or common to all humans from those that are shaped by particular variables in the social and physical environment (Jensen, 2011).

> **cultural psychology** the study of how cultural practices shape psychological and behavioural tendencies and influence human behaviour.
>
> **cross-cultural psychology** the study of what is generally or universally true about human beings regardless of culture.

Psychobiology/Neuroscience: Exploring the Origins of the Mind

Interest in the biological basis of psychological phenomena can be traced through the work of Hippocrates, Aristotle, and Pavlov, as well as myriad other researchers, including Freud. Thus, it is not surprising that eventually a distinct area of psychology, called *psychobiology*, emerged. Psychobiology attempts to explain psychological functions by looking primarily at their biological foundations (Legg, 2016; Sprague & Epstein, 2013). In particular, psychobiology explores brain structure and brain activity and the ways they might be related to individual behaviours and group dynamics. The term *psychobiology* has largely fallen into disuse, with this subfield of psychology now more frequently referred to as **neuroscience**.

> **neuroscience** the study of psychological functions by looking at biological foundations of those functions.

Early psychobiology gained momentum with the advancement of scientific and medical techniques. Karl Lashley (1890–1958), one of the most influential psychobiologists working in the area of learning and memory, based his work on the study of animal neurological functioning. He used surgical techniques to destroy certain areas in the brains of animals and then observed the effects of such destruction on memory, learning, and other cognitive processes. Lashley found that the tissues within certain areas of the brain were often linked to particular cognitive functions. His ultimate goal was to pinpoint all areas of the brain responsible for memory, learning, and other higher functions. He was never able to fully accomplish this goal, and it continues to be of primary interest in contemporary research (see lower photo).

Canadian neuropsychologist Donald Hebb (1904–1985; see photo) developed the concept of the *cell assembly* to describe a network of neurons that develop strengthened internal synaptic connections with repeated stimulation; this assembly activates together during

particular mental processes. He strongly opposed radical behaviourism and is often credited for rejuvenating interest in physiological psychology at a time when behavourism was dominating the field (Brown, 2016).

Chris F. Payne/McGill University Archives, PR000387

Donald Hebb The Canadian Psychological Association awards the Donald O. Hebb Award for Distinguished Contributions to Science to a Canadian psychologist who has made a significant and sustained contribution to the science of psychology.

While working with Donald Hebb and Peter Milner at McGill University, James Olds (1922–1976) discovered the "reward centre" in the brain by demonstrating that electrical stimulation in the brain could evoke emotional responses in animals (Olds & Milner, 1954). They discovered that rats would press a lever for electrical stimulation in a brain area known as the septal region at the same rate as animals working for natural rewards such as food and water (1956, 1958), indicating that the electrical stimulation was rewarding and served as a reinforcer for the lever press.

Roger Sperry (1913–1994), a researcher who was influenced greatly by Lashley, pioneered *split-brain* research on animals. In 1981, Sperry won the Nobel Prize in Physiology and Medicine for his split-brain work. (He shared the prize that year with two other Nobel laureates, David Hubel from Canada and Torsten Wiesel from Sweden, for their work on the structure and function of visual cortex.) Sperry and his colleagues severed the connections responsible for relaying information between the left and right hemispheres, or halves, of the brain. They found that even after the brain is split surgically, the two hemispheres of animals can often function and learn independently. Later investigators found similar results when they studied human beings who had undergone a similar split-brain surgery to stop severe seizures from spreading from one side of the brain to the other (Gazzaniga, 2010, 2005). Split-brain research on both animals and humans made it possible to study the separate functioning of the brain's hemispheres, which, as we'll see in Chapter 3, remains a popular topic in contemporary psychology.

A number of psychological subfields have been influenced by the field of neuroscience, as well as by Darwin's early work on evolution. **Behavioural genetics**, for example, studies

the influence of genes on cognition and behaviour. This is not a completely new field. Early in the twentieth century, and even during the rise of behaviourism, a number of animal researchers used evolutionary principles to help explain human behaviour (Dall, McNamara, & Wilson, 2019).

behavioural genetics a subfield of psychology looking at the influence of genes on human behaviour.

Karen Kasmauski/Getty Images

Studying the human brain **Neuroscientists examine brain structure and brain activity to determine how they are related to behaviour. Here a researcher dissects the brain of a former patient with dementia as part of a study to learn more about memory and memory disorders.**

Although it can be difficult and at times misleading to identify evolutionary roots for today's behaviours, the study of genetic inheritance continues to play an important role in psychology. Indeed, many investigations conducted over the past two decades have established the importance of genetic influences on human development. Few of today's psychologists question the contribution of genetic factors to mental functioning and behaviour.

Similarly, **sociobiologists**, as they were initially called, theorized that humans have an innate concept of how social behaviour should be organized. In 1975, the father of sociobiology, Harvard neurobiologist and naturalist Edward O. Wilson (1929–), a world renowned specialist on ants, brought great attention to this view with his book *Sociobiology: The New Synthesis*. Wilson used sociobiological and evolutionary principles to argue that animal behaviour is governed by epigenetic rules. Epigenetics is the study of how environmental influences affect gene expression and change behaviour. (We will discuss epigenetics in greater detail in Chapter 4.) This claim began a heated debate about whether this "biological basis for behaviour" applies to humans. Wilson and other

sociobiologists argued that the concept of *tabula rasa* is incorrect because humans are genetically more predisposed than other organisms to learn language, create culture, protect territory, and acquire specific societal rules and regulations. Sociobiologists did not claim that genetic influences are necessarily more important than environmental factors, such as parenting or the mass media. Rather, they proposed that our social behaviour is the result of biological *and* cultural influences. However, they note that the environment is limited by genetics in terms of the influence environmental factors can exert in altering human behaviour (Barlow, Silverberg, & LIvingstone, 2019).

> **sociobiologists** theorists who believe humans have a genetically innate concept of how social behaviour should be organized.

The subfield of sociobiology is now part of a still broader subfield called **evolutionary psychology**, one of the major perspectives in psychology today (see **Table 1.2**). Evolutionary psychologists maintain that the body and brain are largely products of evolution and that genetic inheritance plays an important role in shaping thought and behaviour. The laws of evolutionary psychology are thought to apply to all organisms and to a diverse range of mental functions and behaviours (not only social ones), just as the laws of physics apply to matter and energy.

> **evolutionary psychology** a field of study believing that the body and brain are products of evolution and that genetic inheritance plays an important role in shaping the complete range of thoughts and behaviours.

Evolutionary psychology has become a popular topic in contemporary psychology (Confer et al., 2010; Buss, 2005). Evolutionary psychologists suggest that some behaviours and mental processes are more effective than others at solving problems of living—namely, those that help people to survive and reproduce. These successful strategies are naturally selected and passed on to future generations. We'll look at evolutionary psychology in greater detail in Chapter 3.

Mlenny/Getty Images

Cultural universality Psychologists are interested in what stays the same and what varies across cultures within human families.

One goal of evolutionary psychologists is to identify **cultural universality**, human behaviours and practices that occur across all cultures (see photo). Just as behaviourists study animal behaviour to identify simple actions that form the basis of more complex human behaviours, evolutionary psychologists believe that uncovering universal human behaviours will help identify inborn functions common to all humans. Theoretically, such knowledge will answer important questions about the relative impact of biological factors and life experiences on our development.

cultural universality behaviours and practices that occur across all cultures.

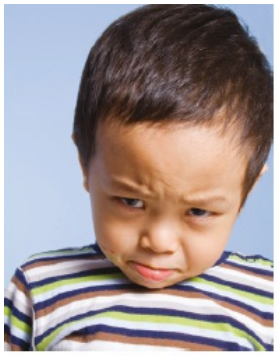
Throughout this book, we'll be observing a number of common practices displayed by people across cultures, such as using specific facial expressions to express emotions (see photos), displaying a fear of death, telling stories, and giving gifts (Matsumoto & Juang, 2016). Throughout the text, we will explore whether such commonalities are the direct result of evolutionary forces. That is, are these behaviours and reactions passed on from generation to generation largely because they remain highly adaptive or is there some other explanation?

TABLE 1.2

The Major Perspectives in Psychology Today

Perspectives	Major Emphases
Psychoanalytic	Interactions between the conscious and unconscious mind govern virtually all behaviour; childhood experiences set the

	stage for later psychological functioning.
Behavioural	Only observable behaviour can be studied scientifically. Perspective focuses on stimulus–response relationships and the consequences for behaviour.
Humanistic	People can be helped to realize their full and grand potential, which will inevitably lead to their positive psychological growth.
Cognitive	Mental processes are studied using an information-processing model (inputs/outputs).
Psychobiology/neuroscience	Psychobiological functions are explained primarily in terms of their biological foundations.
Evolutionary	Behaviour and mental processes are explained in terms of evolution, inheritance, and adaptation.
Socio-cultural	Norms and rules of society are learned through interacting with others. Such behaviours may be culturally universal or may vary cross-culturally.


azmendoza/Getty Images

ruizluquepaz/Getty Images

hadynyah/Getty Images

hadynyah/Getty Images

That certain look **Facial expressions of sadness (left two photos) and happiness (right two photos) are universal across all cultures (Tanaka, 2017). Are these commonalities related to our evolutionary history?**

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

9. Which theorist is most closely associated with psychoanalytic theory—the theory that unconscious conflicts, rooted in childhood, affect much of our behaviour?

10. According to behaviourist theorists, what are the various reinforcement principles, and what impact does each have on behaviour?

11. What did humanist theorist Abraham Maslow suggest is the ultimate goal of human beings?

12. What are cognitions?

13. What is the main idea of evolutionary psychology?

What Do You Think? • Which of the theories presented here depend largely on biological principles? Which of the theories seem to be based more on environmental explanations? And which appear to rely on an interaction of factors? Do you find one theory to be more plausible than the others? Why?

Psychology Today

LEARNING OBJECTIVE 5

Describe the three major branches of psychology and summarize key trends in psychology.

In the contemporary field of psychology, we can recognize the influence of various schools of thought that date back to the days of Greek philosophers. The psychological orientations we have discussed in this chapter, such as neuroscience, behaviourism, and cognitive science, have not disappeared, but rather continue to develop and interact with one another. Indeed, today there is broad recognition that psychology must be as diverse as the humans whose behaviour it attempts to explain (Anderson, 2013; Mullet & Wolf, 2016).

More detailed information is available now than ever before about how the brain functions, and this information in fact emphasizes the importance of analyzing human thought and behaviour at a variety of levels. Brain-imaging studies have, for example, been used to test behavioural principles, identifying which areas of the brain are activated when a behaviour is performed or when an outcome is better (or worse) than expected (Aguirre, 2010). Similarly, cognitive psychologists and biologists have examined psychoanalytic notions, such as the proposal that our unconscious minds hold memories that might be too anxiety-provoking for our conscious minds. Recent investigations have linked real memories to one pattern of brain activity and false memories to another (Ankudowich, Pasvanis, & Rajah, 2017; Jeye, Karanian, & Slotnick, 2017).

TABLE 1.3

Areas of Study for Canadian Psychology Graduates

Areas of Study	Percentage
Applied social	4.7%
Clinical	44.4%
Clinical—neuropsychology	6.0%
Counselling	20.2%
Developmental	9.0%

Experimental	13.7%
Industrial/organizational	4.0%
School/educational	10.5%
Other	9.8%

(Total exceeds 100% due to the option to select multiple responses.)

Votta-Bleeker, L., Tiessen, M., & Murdoch, M. (2016). A snapshot of Canada's psychology graduates: Initial analysis of the 2015 Psychology Graduates Survey. *Canadian Psychology/Psychologie Canadienne*, *57*(3), 172–180.

Video PSYCHOLOGY@WORK

Personnel Recruitment, Selection, and Placement **This video describes the historical roots of the subdiscipline of industrial/organizational psychology. It looks at the personnel selection and placement problems associated with selecting, training, and deploying military recruits in World War II and points to the growth of the field's central role in workplace settings and tasks since then.**

As the diversity of the field has increased, so too has the need for there to be communication among its various voices. Indeed, Canada's nearly 19,000 psychologists (Statistics Canada, 2006) are represented in various professional organizations, including the Canadian Psychological Association (7000 members and affiliates), the Canadian Society for Brain, Behaviour and Cognitive Science (400 members), and the American Society for Neuroscience (38,000 members), and many are also members of the American Psychological Association, which has approximately 150,000 members around the world who collectively address the interests and needs of more than 54 different specialties in psychology. Find out about what industrial/organizational psychologists do, like helping organizations with recruitment, selection, and placement of new employees, by watching the Psychology@Work video on Personnel Recruitment, Selection, and Placement. Although the number of Canadian psychologists across different subfields is unknown, **Table 1.3** shows the variety of fields of study in psychology today according to a survey by the Canadian Psychological Association of recent graduates from psychology programs across Canada (Votta-Bleeker et al., 2016).

Branches of Psychology

The three current key branches of psychology are: *academic psychology*, *clinical and counselling psychology* (including clinical, counselling, and clinical neuropsychology), and *applied psychology* (the rest, including school, rehabilitation, industrial/organizational, health, and forensic psychology). **Table 1.4** shows the variety of job settings where recent psychology graduates from Canadian universities work. Psychologists from all three branches share an interest in mental processes and behaviour. They differ in the amount of emphasis they each place on the psychology of individuals, the discovery of general principles of psychology, and the application of psychological knowledge to groups of people (Norris, 2019). **Table 1.5** summarizes the range of settings in which recent graduates from psychology programs across Canada work. The section "What Can You Do with a Psychology Degree?" at the end of this chapter explores various careers that a psychology degree can lead to.

TABLE 1.4

Where Psychologists Work

Job Setting	Percentage
Therapist/counsellor	70%
Researcher/analyst	17%
Consultant	6%
Other	5%
Instructor	3%

(Total exceeds 100% due to the option to select multiple responses.)

Austin, N. (2017). Employment by discipline: Part two. TRaCE: Future Humanities: Transforming Graduate Studies for the Future of Canada. McGill University. Downloaded from http://iplaitrace.com/employment-by-discipline-part-two/, April 2, 2017.

TABLE 1.5

A Snapshot of Canada's 2015 Psychology Graduates

Work Setting	Percentage
Academia	26.9%
Hospital/health care	25.1%
Independent practice—solo	23.6%
School/education	13.7%
Independent practice—group	12.2%
Government	7.3%
Private sector	5.6%
Not-for-profit/NGO	5.5%
Research	5.5%
Community	3.7%
Corrections	2.4%
Military	0.7%
Other	4.7%

(Total exceeds 100% due to the option to select multiple responses.)

Votta-Bleeker, L., Tiessen, M., and Murdoch, M. (2016). A snapshot of Canada's psychology graduates: Initial analysis of the 2015 Psychology Graduates Survey. *Canadian Psychology/Psychologie Canadienne* [serial online], *57*(3):172–180.

Academic Psychology

When Wilhelm Wundt founded psychology as a discipline distinct from philosophy in 1879,

his goal was to examine "pure" academic knowledge and human nature (Bunn, 2017). He did not focus on questions of how psychology could be applied or used outside the laboratory. Today, the branch of psychology known as **academic psychology** involves research and instruction on a wide variety of psychological topics.

> **academic psychology** a branch of psychology focusing on research and instruction in the various areas or fields of study in psychology.

Academic psychologists typically work at colleges and universities, where they often divide their time between teaching and conducting research in their particular fields of interest. A *developmental psychologist*, for example, may teach courses on child development while also researching how children think and behave. The efforts of academic researchers have resulted in a large body of psychological knowledge and, for the most part, the chapters throughout this textbook reflect their considerable work and findings.

Applied Psychology

Today, the branch of psychology called **applied psychology** involves the application of psychological principles to help solve practical problems in human resources, education, marketing, and other fields (Hagermoser Sanetti & Kratochwill, 2014). There are a number of specialized programs of study within applied psychology. One specialty area in applied psychology is *industrial/organizational psychology*. This area of psychology focuses on applying the research from psychology to issues in organizations and workplaces (Kelbway, 2019). For example, psychologists might consult with business managers to address selection, motivation, or performance issues in a corporation. Another specialty area in applied psychology is sports psychology. *Sports psychologists*, for example, may provide guidance to athletes or teams, helping them overcome feelings of anxiety or frustration or teaching them to focus their energy more effectively (Reynolds & Salas, 2016). Throughout this book, we will examine a wide range of research developments, both those with immediate practical applications and those that serve to further our insights about the human mind and behaviour.

> **applied psychology** the branch of psychology applying psychological principles to practical problems in other fields, such as education, marketing, or industry.

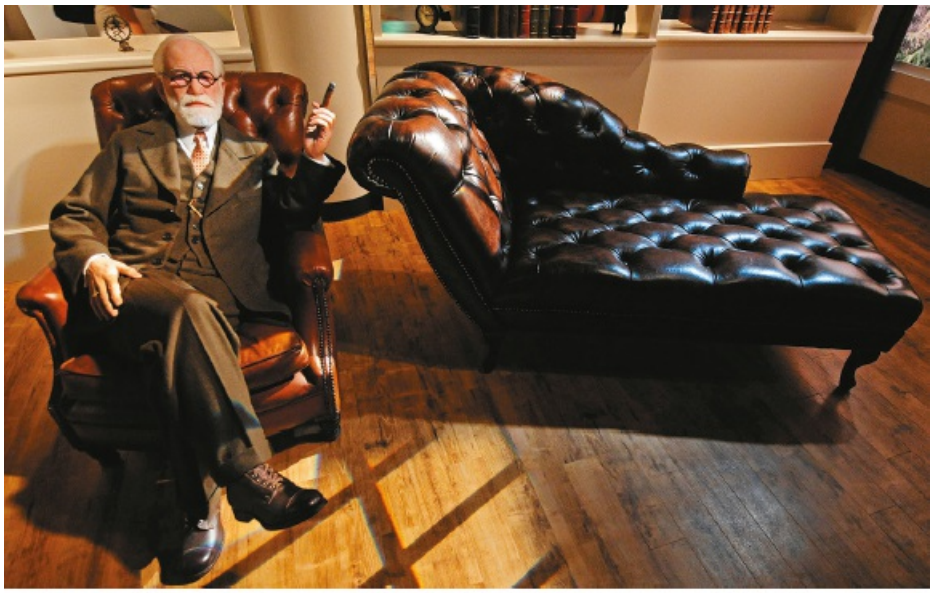
Clinical and Counselling Psychology

Clinical and counselling psychology help individuals to cope more effectively or to overcome abnormal functioning. Actually, there are several different types of mental-health practitioners.

> **clinical and counselling psychology** the study of abnormal psychological behaviour and interventions designed to change that behaviour.

> *Clinical psychologists* generally provide *psychotherapy*, which involves helping people to modify thoughts, feelings, and behaviours that are causing them distress or inhibiting their functioning (see photo). They also may administer and interpret

psychological tests to provide further information relevant to treatment. Many clinical psychologists earn a Ph.D. degree awarded by a university graduate program, which typically requires training in therapeutic practices and in the conduct and interpretation of research. Some clinical psychologists earn a Psy.D. (doctorate of psychology) degree. This degree is awarded by graduate programs that place less emphasis on research and greater emphasis on psychotherapy and psychological testing. As well, clinical psychologists who wish to practise psychotherapy in Canada must be registered with their provincial College of Psychologists, which establishes and oversees practice guidelines and the ethics of clinical practice.



CLEMENS BILAN/Getty Images

The couch Sigmund Freud's signature psychotherapy procedure was to have patients lie on a couch and say whatever came to mind while he took notes behind them. This wax recreation of the neurologist and his office is on display at a museum in Berlin, Germany.

Counselling psychologists and psychiatric social workers also provide psychotherapy for people with psychological problems. These professionals may also help individuals and families deal with issues tied to relationships, careers, child-rearing, and other important areas of functioning. In addition, some social workers provide aid to families through social service systems that are available in the community. Counselling psychologists earn a Ph.D. or Psy.D. in their field, while social workers earn either an M.S.W. (masters of social work) or D.S.W. (doctorate of social work) degree from a school of social work.

Canadian psychologists are not able to prescribe drugs for their clients. In the United States, only five states, New Mexico, Louisiana, Iowa, Idaho, and Illinois currently grant prescription privileges to psychologists who receive special pharmacological training. The U.S. territory of Guam also grants such privileges to psychologists (Bethune, 2017).

Psychiatrists, who may also provide guidance and therapy to individuals, are

professionals who attend medical school and earn an M.D. (doctorate of medicine). Psychiatrists generally have less training in psychological research and testing than clinical psychologists, but they have medical knowledge and the ability to prescribe medications for abnormal emotional states or behaviour problems.

Shared Values

Although the three branches of psychology—academic, applied, and clinical and counselling—have different goals and ways of meeting those goals, they do share important values that guide their work. Many of those values will shape our discussions throughout this textbook, so let's take a look at them here.

Psychology is theory-driven. If you're going to explain human behaviour, you have to have a theory. We will describe the elements of a good theory in Chapter 2. Psychologists have developed theories, or potential answers, for many key questions: Do mental processes exist? What are the relative roles of biological inheritance and environmental influence in shaping human psychology? How do we explain deviant behaviour, such as bullying? Each school of psychology provides ideas to help answer such questions. And every branch of psychology uses its potential answers to guide research or improve psychological interventions.

Psychology is empirical. From the beginning, psychology differed from other human disciplines, such as philosophy, because of its emphasis on controlled observations and experimentation. Psychology finds more use and value in ideas that receive strong empirical, or research, support, than in ideas, even seemingly compelling ones, that cannot be supported with evidence from systematic testing.

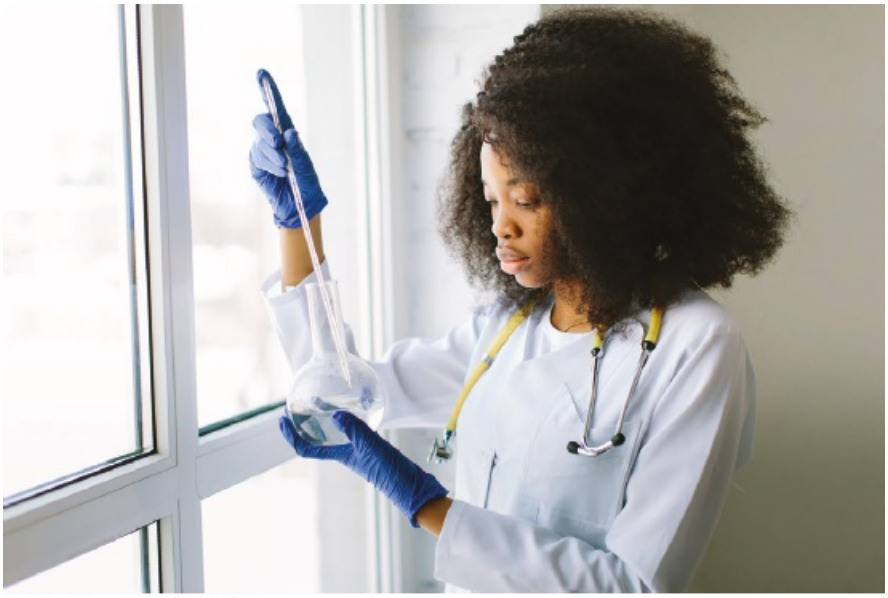
Psychology is multi-level. As we discussed at the beginning of this chapter, to understand the complete picture of human mental processes and behaviour, psychologists must account for what is happening at the levels of the brain, the person, and the group. Although certain theories place more emphasis on one level than another, all of the levels are indeed operating to influence whatever mental process or behaviour we may be observing. Thus, in chapters throughout this textbook, we will be presenting evidence about what happens at each of these three levels.

Psychology is contextual. At one time the thought of Internet social networks—actually, even the thought of the Internet—was unimaginable to most people. As the history of psychology shows, however, technological advances have had a strong influence on the development, rise, and fall of particular theories. Without the computer, for example, the field of cognitive psychology would have been described very differently. In fact, technological and other societal changes force us to look at human behaviour from new perspectives that broaden our awareness. All of this means that some of the theories you're studying today may eventually go the way of structuralism—influential but dramatically changed in nature. This is the way that science progresses.

Current Trends in Psychology

The values of psychology—theory-driven, empirical, multi-level, and contextual—work together to drive constant progress and change in the field. Today, those values, as well as larger social developments, are shaping several trends in psychology. In particular, the field

is growing more diverse, continuing to profit from technological advances, and continuing to give birth to more optimistic schools of thought.



Sofiia Shunkina/123 RF

Growth of women Ph.D.s in psychology **Over a 30-year period, the increase in the percentage of women earning Ph.D.s has been dramatic, especially in the clinical, developmental, and counselling fields (Gathercoal et al., 2010; Lips, 2016).**

Growing Diversity

Early in the history of psychology, most women as well as most members of racial minority groups were unable to gain access to the advanced education and professional status necessary for contributing to the field (see Psychology Around Us 1.2). As psychology itself has grown more diverse, however, so have psychologists. Currently, psychology has more women earning graduate degrees than does any other science (see photo). Indeed, 73.6 percent of psychology graduates in Canada are women (CIHI, 2013). In addition, 16 percent of newly earned Ph.D.s are awarded to minority group members, compared with 7 percent 30 years ago (APA, 2009).

Growing diversity among psychologists has overlapped with an increased interest in the diversity of the people they study, treat, and influence. With few exceptions, for decades psychological research focused on Western cultures and middle- to upper-class socio-economic groups. More recently, cultural psychology (also called cross-cultural psychology) has become an important area of investigation. As we observed earlier, this field of study seeks to uncover mental processes that exist across all cultures, as well as identifying important cultural differences (Schaller et al., 2011).

Cultural psychologists often focus on differences between **collectivist** cultures and **individualistic** cultures. Members of *collectivist* cultures emphasize the needs of the group and subsume individual desires to those of the family or peer group. In contrast, *individualistic* cultures stress the identity and needs of the person over those of the group.

collectivist a culture whose members focus more on the needs of the group and less on individual desires.

individualistic a culture that places the wants or desires of the person over the needs of the group.

Historically, studies have focused on Eastern cultures, which are viewed as more collectivistic, and Western cultures, which are viewed as more individualistic. There is, however, growing evidence that this perspective is oversimplified. For example, research by Talhelm et al. (2014) has suggested that large differences can exist *within* cultures as well as *between* cultures. These researchers suggest that major psychological differences within China are associated with whether the populations have been historically rice-growing cultures (interdependent) or wheat-growing cultures (independent). Another example of differences identified within cultures is research pointing to differences between Asian Americans and European Americans in the United States (Uskul & Oyserman, 2010). Such findings suggest that commonly used dichotomies must be examined more critically.

1.2 Psychology Around Us

Notable Women in Psychology

As you have already no doubt observed, the early history of psychology largely recognizes the work of men, as is typical of most fields (Campbell, 2013). Nevertheless, from early on women were very much involved in shaping psychology (Pickren & Rutherford, 2010). A small number of these women's contributions are noted below. Today the majority of our undergraduate and graduate students in psychology are women. In fact, CPA now has a community of researchers, teachers, and practitioners who focus on the psychology of women and on feminist psychology (CPA, 2020). Here are but a few of the field's female pioneers (Keates & Stam, 2009).

The work of Mary Whilton Calkins (1863–1930) was noteworthy for her emphasis on the self, consciousness, emotions, and dreams, which stood in stark contrast to John Watson's behaviourist movement at the time. Calkins was the first woman president of the American Psychological Association (APA).

Leta Hollingsworth (1886–1939) was best known for her studies of "mentally deficient" and "mentally gifted" individuals, and for her views on gender differences in mental functioning. She was one of the first theorists of her time to challenge the notion that women were biologically inferior, arguing instead that women were victims of a male-dominated social order.

Magda Arnold (1903–2002) is generally thought of as the "mother of modern emotion theory" (Keates & Stam, 2009). She received her Ph.D. at the University of Toronto in 1942. Her book *Emotion and Personality* (1960) consolidated her position as a leader in emotion research.

Mary Salter Ainsworth (1913–1999) was also a University of Toronto graduate, obtaining her Ph.D. in 1939. She is internationally known for her work on mother–

infant attachment and for the development of the Strange Situation method of assessing attachment in toddlers.

Mary Wright (1915–2014) is best known for her work on the history of Canadian psychology. She also wrote of the history of the development of the Canadian Psychological Association. She was elected the first woman president of the CPA in 1968.

Brenda Milner (1918–) has been a pioneer in the study of memory and other cognitive functions in humans. She was the first to investigate how damage to the brain's hippocampus affects memory through her study of a famous amnesia patient known as H.M. in the research literature.

For further information, Alexandra Rutherford at York University maintains a website for the American Psychological Society: Society for the Psychology of Women Heritage at www.feministvoices.com.

Advances in Technology

With recent innovations in neuroscience, a contemporary area known as cognitive neuroscience has emerged. This area focuses on the neural substrates of the mind. **Cognitive neuroscience** focuses on how specific neural connections in the brain affect cognition and mental functioning. Researchers in this area might study the causes of psychiatric disorders or normal brain composition or function.

cognitive neuroscience the study of mental processes and how they relate to the biological functions of the brain.

One goal of cognitive neuroscientists is to link specific mental processes to particular brain activities. Similarly, a field called **social neuroscience** has emerged, which seeks to link social functioning to particular brain activities. Recent studies have, for example, found that there is a network of nerve cells in the brain that is activated when we show empathy, our ability to understand and share the feelings of others (Lamm, Rütgen, & Wagner, 2019).

social neuroscience the study of social functioning and how it is tied to brain activity.

Cognitive and social neuroscience are currently among psychology's more active areas of theory and research. We have indicated sections relevant to neuroscience research throughout the book with the icon "Brain Function" In these sections, you'll learn about the neuroscience of memory, emotions, social behaviour, and the like. You'll discover, for example, what happens in the brain when you are learning new material before an important test (Law & Clow, 2020), and then again when you get together with friends to celebrate the completion of that test (Kabat-Zinn, 2018).

The development of imaging tools, computer technology, and a number of biological techniques has also helped enhance our understanding and treatment of mental dysfunction in recent years. These tools have enabled researchers to look directly at the brains of disturbed persons while they are feeling sad or anxious, hearing voices, or

recalling repressed memories. Such studies have helped reveal that depression, for example, is related not only to traumatic childhood experiences, significant losses in life, and feelings of helplessness, but also to abnormal activity of key chemicals in the brain (Djelantik et al., 2020; Grigoriev, 2020; Trindade, Mendes, & Ferreira, 2020; Van Assche, Van de Ven, Vandenbulcke, & Luyten, 2019). Given such wide-ranging insights, we have indicated relevant sections throughout the book with the icon "Atypical Development." In these sections, we discuss what happens when typical psychological processes, such as memory, emotional coping, social engagement, and so on develop in a different way.

At first glance, psychology's intensified focus on the brain may make it appear that technology and biology are dominating contemporary psychology. However, it is unlikely that psychology will ever be overtaken by biology. Indeed, recent findings in cognitive neuroscience and other areas suggest that our insights about mental functions (and dysfunctions) and about behaviour are most complete when the different branches of the field intersect. In clinical psychology, for example, it is now clear that many mental disorders are best understood and treated when explanations and techniques from different schools of thought are combined.

One important area of psychology that has intersected with other areas of the field for many years is developmental psychology, the study of how we change over the course of our lives. Developmental psychology has both incorporated and contributed to research in areas such as our use of language, our emotions, our personalities, and the structure of our brains. We indicate the cross-fertilization of development with other areas throughout the book with the icon "Development."

Greenseas/Getty Images

Accentuating the positive **Expressing gratitude to essential workers during COVID-19 positively supports the sacrifices made by others but also magnifies positive emotions for the person expressing gratitude. Positive psychologists study the impact that happiness and positive emotions have on human functioning.**

Positive Psychology

As we saw earlier, historical schools of thought in psychology sow the seeds for related but new ideas. We can see, for example, influences of the functionalists, who were interested in applying psychological research, and the humanists, who were interested in helping people achieve their highest potential, when we look at a relatively new movement in the field called *positive psychology* (Seligman, 2011). Positive psychology studies human strengths, fulfillment, and creativity (Compton & Hoffman, 2013; Wright, 2017). Positive psychologists point out that psychology is over-focused on weakness, psychopathology, psychological damage, and ways to treat suffering. They argue that psychology ought to also consider the factors that make life worthwhile, including happiness, meaning in life, and character strengths, as well as increased attention to how those features of positive living might be more readily developed (Baumgardner & Crothers, 2009; Seligman, 2002; Seligman & Csikszentmihalyi, 2000). The positive psychology movement garnered immediate attention and momentum. Only 15 years after Seligman began to promote the science and practice of positive psychology, there are hundreds of courses taught in universities throughout Canada and the United States on this field of inquiry. The Flourishing Centre, the Canadian Positive Psychology Association, and the International Positive Psychology Association are but a few of the many organizations that have formed with the mandate of sharing positive psychology within the field. There is also a *Journal of Positive Psychology*.

A growing body of research does indeed suggest that positive emotions can have a profound impact on development and behaviour (see photo). As you'll see in a later chapter, when we discuss stress, coping, and health, a number of studies have found that having a positive outlook promotes *resilience*, the ability to bounce back in the face of adversity (Garbarino, 2011; Kato et al., 2016; Sagone & De Caroli, 2014). Similarly, studies indicate that positive emotions may boost the functioning of our immune systems.

In Chapter 16, we'll see that some psychologists have even developed a new form of therapy, called *positive psychotherapy*. This type of therapy does not target specific symptoms of mental dysfunction, but instead focuses on increasing the positive emotions and sense of engagement and meaning experienced by clients (Rashid, 2015; Wong & Roy, 2018). According to proponents of positive psychology, certain techniques and behaviours can be of particular help to people in their efforts to achieve happiness or return to happiness after unpleasant events.

What Can You Do with a Psychology Degree?

Psychology is the study of behaviour and mental life. Students who major in psychology gain a broad understanding of the dynamics of human behaviour from a wide range of perspectives, including developmental, social, clinical, and biological. They also acquire a body of knowledge and set of skills that help qualify them for a broad range of career choices (Norris, 2019).

Individuals who want to become psychologists will find that an undergraduate degree in psychology prepares them to pursue graduate degrees in any number of psychology subfields, including clinical, health, cognitive, social, neuroscience, organizational, educational, and sports psychology (see photo). Alternatively, being an undergraduate major in psychology can help open the door to graduate study in many other fields, such as

law, business management, economics, and medicine.

Graduate study is not for eveyone. An undergraduate degree in psychology can lead to career opportunities in areas such as the non-profit sector and business. Psychology majors are typically viewed by prospective employers as well-qualified to work in fields that require people skills, as well as having strong analytical, research, and writing abilities. "But," you might say, "just about every job deals with people." Yes, you are right, that's exactly the point.

An undergraduate degree in psychology particularly qualifies individuals for entry-level jobs in people-oriented careers such as communications, marketing, human resources, sales, and business. Beyond people skills, the analytic, research, and writing skills of psychology majors enhance their eligibility for human-service, legal, and law-enforcement jobs, including positions as paralegals and corrections officers. Furthermore, the same skills may make individuals good candidates for careers in general business, marketing research, management consulting, computer game design, and investment banking.

In short, psychology is related to so much in our world that a degree in this discipline can lead to work and careers in many areas and fields. For example, psychologists Daniel Kahneman (2002) and Herbert Simon (1978) are Nobel Laureates in *economics*, while the neuroscientists Eric Kandel (2000), Rita Levi-Montalcini (1986), and Roger Sperry (1981) won their Nobel Prizes in *medicine* and *physiology*. For more information on careers in psychology, go to the Canadian Psychological Association web page "Careers In and Related to Psychology" at www.cpa.ca/students/career/careersinpsychology.

NASA Image Collection/Alamy Stock Photo

Psychology's wide influence **Astronaut Chris Hadfield on a mission STS-100 spacewalk. The Canadian Space Agency has two directorates (the Canadian Astronaut Office and Space Sciences) that focus on applied psychological and neuroscience research to maximize astronauts' performance.**

What Changes and What Remains Constant?

Since the early years of Greek philosophy, theorists have attempted to determine how the human mind operates and whether there are universal laws that govern mental processes and behaviours. Those questions remain at the forefront of contemporary psychology as

today's neuroscientists, cultural theorists, and other psychologists try to determine how the mind and body are related, whether there are knowable universal truths about mental processes and human behaviours, and whether such truths are best understood through the perspective of the brain, the individual, or the group, or a particular combination of the three. It is not likely that psychology can ever provide complete answers to these complex questions. However, striving to uncover even partial answers has already uncovered a wealth of information about how human beings function and has produced a range of compelling theories and research findings.

As you read about these theories and findings throughout this textbook, you will do well to keep asking yourself a question raised by Carl Jung (1875–1961), one of the field's most famous clinical theorists: "How much truth [is] captured by this [particular] viewpoint?" Ideas move in and out of vogue, and what is accepted today as a useful or accurate outlook might not be seen the same way tomorrow.

Both historical and social forces determine the focus of scientific energy. Psychology, perhaps more than any other field, struggles constantly to achieve a proper balance between popular trends and interests, societal influences, and scientific objectivity (Araujo, 2017; Walsh, Teo, & Baydala, 2014; Watrin, 2017). Although fads and fashions will likely continue to exert some influence on the development of psychology in the coming years, it is important to recognize that such fads hardly comprise the substance of the field. Moreover, we must always keep in mind the limitations of psychology (or of any discipline) in answering the basic questions of human existence. As we noted at the beginning of this chapter, scientific knowledge serves as a *means* for exploring such questions rather than an end.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

14. What are the three major branches of psychology?

15. What is cultural universality, and what kinds of psychologists are interested in it?

16. What is the focus of positive psychology?

What Do You Think? • Which branch of psychology most appeals to you as a potential profession? Why? What kinds of things do you think would be important for positive psychologists to study?

Summary

What Is Psychology?

LEARNING OBJECTIVE 1 Define *psychology* and describe the goals and levels of analysis psychologists use.

Psychology is the study of mental processes and behaviour.

The goals of psychology are to *describe, explain, predict*, and *control* behaviour and mental processes. Psychologists vary in the degree to which they focus on some of these goals more than others.

The study of psychology must occur at multiple levels, including the level of the *brain* (the biological activity associated with mental processes and behaviour), the level of the *person* (the content of mental processes), and the level of the *group* (social influences on behaviour).

Psychology's Roots in Philosophy

LEARNING OBJECTIVE 2 Describe the influences of early myths, rituals, and ancient Greek philosophies on psychology.

Early explanations of human behaviour were rooted in superstition and magic.

Later, philosophers, beginning with the ancient Greeks, tried to develop more objective theories of human consciousness and reality.

The work of such early philosophers as Hippocrates, Plato, and Aristotle contributed to the later formation of psychology as a natural science.

The Early Days of Psychology

LEARNING OBJECTIVE 3 Name important early psychologists and describe their major theories and research methods.

The development of psychology has been strongly influenced by shifts in the social environment and development of new technology.

The first psychology laboratory was founded in Leipzig, Germany, by physiologist Wilhelm Wundt. Wundt was interested in human consciousness and will, which he studied through small, structured activities that could be easily watched and replicated.

Structuralism, a school of thought developed by one of Wundt's students, relied upon the use of introspection, the careful observation of human perception. The goal of the structuralists was to find the smallest building blocks of consciousness.

William James helped shift the field's focus to the functions of mental events and behaviours, forming a school of thought known as functionalism.

Gestalt psychologists studied human tendencies to perceive pattern rather than dividing consciousness into its smallest parts. They focused on putting together the "parts," or individual sensations, to create a "whole" or perception that went beyond the sum of the parts.

Twentieth-Century Approaches

LEARNING OBJECTIVE 4 Summarize the major principles of the psychoanalytical, behaviourist, humanistic, cognitive, and neuroscience approaches to psychology.

Over the years, different fields of psychology emerged, with different ideas about what was the appropriate area of study for human psychology. Some of the most influential fields were the psychoanalytic, behaviourist, humanistic, cognitive, and neuroscience schools of thought.

Sigmund Freud's psychoanalytical theory focused on the importance of unconscious mental processes.

Behaviourists believed strongly that psychology should restrict its focus to the careful study of observable behaviours.

Humanistic psychologists reacted against the mechanical portrayals of people by the behaviourists, and emphasized individuals' potential for growth and self-actualization.

Cognitive psychologists reignited interest in the study of mental processes, comparing the workings of the mind to the workings of computers.

Biological science, including interest in the workings of the brain and in our genetic inheritance, was the major influence on neuroscience approaches.

Psychology Today

LEARNING OBJECTIVE 5 Describe the three major branches of psychology and summarize key trends in psychology.

The theoretical and cultural diversity of the field of psychology has increased dramatically over recent years.

There are three key branches of psychology: academic, applied, and clinical/counselling.

Across the three branches and many specialty areas in psychology, psychologists are united by their shared values. Psychologists generally agree that psychology is *theory-driven, empirical, multi-level*, and *contextual*.

Currently, psychology appears to be developing as a science in response to a growing diversity throughout the field, advances in *technology* (such as brain scanning), and the development of *new schools* such as positive psychology.

Key Terms

academic psychology

applied psychology

behaviour

behavioural genetics

behaviourism

client-centred therapy

clinical and counselling psychology

cognitive neuroscience

cognitive psychology
collectivist
consciousness
cross-cultural psychology
cultural psychology
cultural universality
culture
evolutionary psychology
functionalism
Gestalt psychology
humanistic psychology
individualistic
information processing
introspection
mental processes
neuroscience
psychoanalytic theory
psychology
punishment
reinforcement
response
social neuroscience
sociobiologists
stimuli
structuralism
unconscious
voluntarism

Self-Study Questions

Multiple Choice

1. Psychology is defined as:
    a. the science of behaviour.

b. the study of mental processes.

c. the study of mental disorders and their treatment.

d. the science of behaviour and mental processes.

2. Which of the following statements is true regarding the levels of analysis in psychology?

a. Each thought or behaviour occurs at one of the following levels: the level of the brain, the level of the person, or the level of the group.

b. The level of the brain is the most important level of analysis in psychology.

c. Thoughts and behaviours are analyzed at the group level by sociologists and anthropologists, not by psychologists.

d. All thoughts and behaviours occur at all three levels simultaneously.

3. Whereas the Greek philosopher _____ correctly identified the brain as the organ of mental life, _____ believed that the brain was of minor importance.

a. Aristotle; Hippocrates

b. Plato; Aristotle

c. Hippocrates; Aristotle

d. Hippocrates; Socrates

4. With respect to the way that we acquire knowledge, _____ emphasized the role of the mind and reasoning, whereas _____ pointed to the role of sensory experience.

a. Hippocrates; Socrates

b. Aristotle; Hippocrates

c. Plato; Aristotle

d. Aristotle; Plato

5. In which of the goals of psychology were the structuralists most interested?

a. description

b. prediction

c. explanation

d. control

6. Which American psychologist is credited with developing the functionalist approach?

a. Freud

b. Pavlov

c. James

d. Watson

7. Which statement best captures Freud's view of the relationship between the conscious and the unconscious minds?

a. The conscious and unconscious minds operate in isolation from one another.

b. The conscious and unconscious minds cooperate harmoniously.

c. The conscious and unconscious minds are often in conflict.

d. The conscious and unconscious minds are essentially the same.

8. Which twentieth-century perspective in psychology is correctly matched with its emphasis?

a. psychoanalytic perspective—emphasizes people's motivation to grow and develop and gain control over their destinies

b. humanistic perspective—emphasizes how people process information

c. behavioural perspective—emphasizes observable behaviour and objectivity

d. cognitive psychology—emphasizes the unconscious influences on thought and behaviour

9. A cultural psychologist would describe Western culture as _____ and would describe Eastern culture as _____.

a. individualistic; collectivist

b. individualistic; communal

c. collectivist; collectivist as well

d. individualistic; individualistic as well

10. The advent of computer technology in the 1950s and 1960s spurred growth in the field of _____. More recently, advances in imaging have sparked growth in the field of _____.

a. cognitive psychology; neuroscience

b. neuroscience; cognitive psychology

c. experimental psychology; neuroscience

d. developmental psychology; neuroscience

Fill-in-the-Blank

1. During psychology's early history, the primary method for exploring internal mental processes was to observe outward _____.

2. Psychology's goal of _____ is associated with the desire to limit or increase behaviour.

3. In describing a natural disaster, when ancient peoples said that "the earth spirits were angry," they were explaining their environment through the use of _____.

4. The _____ were the first psychologists to examine socially relevant topics.

5. The Gestalt psychologists made their most lasting contributions to the psychology of _____.

6. Theoretically speaking, undesirable behaviours are less likely to be repeated if the

technique of _____ is used.

7. Maslow proposed that we have a basic motive to fulfill our full potential as human beings, which he described as _____.

8. Behavioural genetics and sociobiology can be seen as subfields of _____.

9. A _____ psychologist would likely help individuals cope more effectively or overcome abnormal functioning.

10. A new school of thought that focuses on features of human functioning like happiness and the more worthwhile aspects of living as well as the meaning of life is referred to as _____ psychology.

CHAPTER 2
Psychology as a Science

Pablo Calvog/Shutterstock.com

CHAPTER OUTLINE

What Is a Science?

LEARNING OBJECTIVE 1 List two core beliefs of science, and describe the steps in the scientific method.

Is Psychology a Science?

LEARNING OBJECTIVE 2 Compare and contrast psychology with other natural sciences, such as biology, chemistry, and physics, and with pseudosciences, such as astrology.

How Do Psychologists Conduct Research?

LEARNING OBJECTIVE 3 List steps in the research process and key characteristics of descriptive and experimental psychological research methods.

How Do Psychologists Make Sense of Research Results?

LEARNING OBJECTIVE 4 Describe what information is conveyed by statistics, including correlation coefficients, means, and standard deviations, and explain how psychologists draw conclusions about cause and effect.

What Ethical Research Guidelines Do Psychologists Follow?

LEARNING OBJECTIVE 5 Describe what ethical steps psychologists take to protect the rights of human research participants.

Here is a simple question: Does watching a violent program on television or playing a violent video game cause people to become more aggressive or violent? Should we be especially concerned about the sorts of programs and images that children are watching on television or the sorts of games children and adolescents are playing online? What do you think?

From children's cartoons, to dramatic programs, to televised hockey (*Hockey Night in Canada*), to games like *Until Dawn, Hatred, Gears of War*, and *Call of Duty* (which are supposed to be restricted to older adolescent use but rarely actually are), there are many opportunities to see acts of aggression and violence on television and to virtually engage in such acts while gaming. But does watching or gaming acts of aggression and violence make children more aggressive and violent? It may be the case that watching violence or playing violent games provides children with ideas for behaviours that would not otherwise have occurred to them (see photos). It also may be that exposure to video violence suggests that violence is an acceptable way to solve disputes. On the other hand, it may be that children who are already prone to violent behaviour as a result of their genes, temperaments, and the ways they have been raised seek out more violent television programs and prefer to play more violent games. In that case, their viewing and gaming patterns are just symptoms of other violence-causing factors.

Many people have strong opinions about this issue, but what we really need to answer the question is some good scientific research. How would you design a study to examine whether watching violent programming or playing violent video games makes children behave more violently? The design process is complicated by the fact that virtually every household in Canada already has at least one television in it, and most Canadian children have access to some sort of gaming system (CRTC, 2019; Caron, Hwang, & McPhedran, 2012). So children who have not watched violent television programming or played violent games might be hard to find and might not be representative of the "typical" Canadian child.

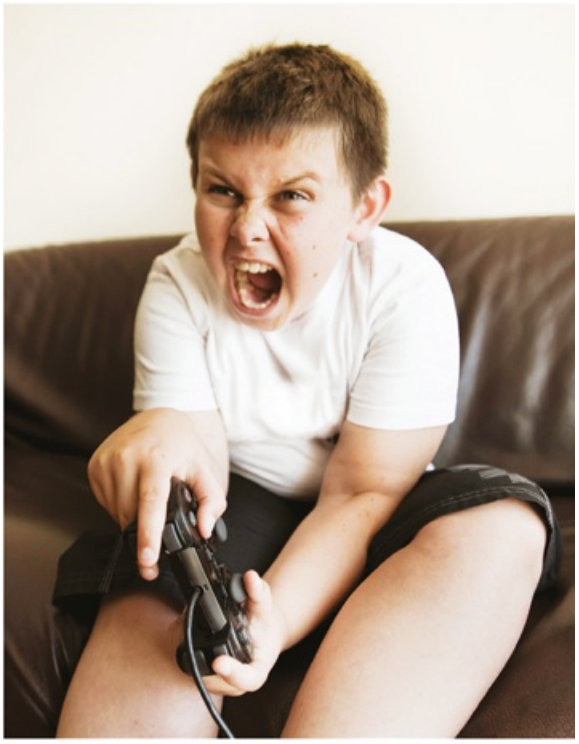
Is there a straightforward answer to the question of whether watching violence on television or playing violent video games makes children more violent? The question is so complex that one study will certainly not provide a clear answer. In terms of television violence, Jonathan Freedman, a social psychologist at the University of Toronto, in his book *Media Violence and its Effects on Aggression* (2002), concludes that "the scientific evidence simply does not show that watching violence either produces violence in people, or desensitizes them to it." In terms of gaming violence, the case, based on reviews of many studies, seems to be a similarly unclear, with some meta-analytic studies suggesting that exposure to violent video games is linked to increases in violent behaviour, aggressive thoughts and feelings, and decreases in levels of helping behaviour (Gunter, 2016; Prescott, Sargent, & Hull, 2018) and other studies also consolidating the results of other studies suggesting there is no link between violent video gaming and future acts of aggression (Przybylski & Weinstein, 2019).

It is evident that even seemingly simple questions do not have simple answers. Welcome to the challenge of designing and conducting good research into human behaviour.

In this chapter, you'll find out exactly what the scientific research methods of psychologists are and how psychologists use them. We'll begin the chapter by defining what science is.

Then we'll consider just how well psychology fits with the definition of a science, particularly in comparison to other fields. Next, we'll examine in some detail the methods that psychologists use to conduct research, including, by way of example, research into the nature and impact of television viewing habits. Finally, we'll look at the statistics that help researchers interpret their results and the ethical rules that guide them when working with humans or animals.

gilaxia/Getty Images



Stanislav Solntsev/Photodisc/Getty Images

Viewing violence and gaming violence **It may be that watching or engaging in virtual acts of aggression and violence models that behaviour for children or suggests that it is an appropriate way to behave.**

What Is a Science?

LEARNING OBJECTIVE 1

List two core beliefs of science, and describe the steps in the scientific method.

Before we look at psychology in particular, take a moment to try to answer the general question, what is a science? You might answer by listing types of sciences, such as chemistry, biology, or physics. You might envision a white-coated person in a lab, mixing strangely bubbling chemicals or lecturing students about where to start an incision on the frog in the tray in front of them. Such things are only *sometimes* associated with science. Two characteristics that all sciences share, however, are similar principles, or beliefs, about how best to understand the world, and reliance on the *scientific method* as a way to

discovering and sharpening knowledge.

Scientific Principles

Science is built on a foundation of core beliefs about the world. Two essential beliefs are as follows:

> *The universe operates according to certain natural laws.* Scientists believe that things happen in and around us in some kind of orderly fashion that can be described using rules or laws. The natural law of cause and effect, for example, suggests that when something is set in motion, it has an effect on other things. Psychologists look for the laws that describe mental processes and behaviour (see photo).
>
> *Such laws are discoverable and testable*. By carefully observing what happens in the natural world, we can figure out the laws governing those events. In turn, we can use these laws to make predictions about what might happen, and we can then experiment to see whether those predictions come true.

As a natural science, psychology operates according to these two core beliefs. Psychology also shares with other sciences a similar logical approach to discovering and testing laws about how things happen: the scientific method (Lalasz, 2011).

Joe Raedle/Getty Images

Law seeking This meteorologist relies on physical laws to describe and predict the force and path of hurricanes. Similarly, psychologists seek out laws that describe and predict mental processes and behaviour.

The Scientific Method

The scientific method relies on processes of logical reasoning derived from philosophy. One way to apply our knowledge of the world is to start with big, general ideas (broad basic principles), and then apply those ideas to specific situations. This approach is called **deductive reasoning**. If you have ever bet (with friends for no money, of course) that a particular team will win a playoff game because it is the home team and you believe the

home team has an advantage, then you have used deductive reasoning. Home teams win more often than visitors, so I will bet that the home team wins (Harris & Roebber, 2019). (Although this belief may not have been the case when professional sports restarted without fans in attendance after opening up after the COVID-19 pandemic (Saunders, 2020).) Can you think of any problems with this approach to reasoning?

> **deductive reasoning** reasoning proceeding from broad basic principles applied to specific situations.

Sir Francis Bacon, a British philosopher and statesman in the early 1600s, was one of the first to question the deductive reasoning approach (Voit, 2019). Bacon felt deductive reasoning was too susceptible to the thinker's **biases**—personal beliefs or conventional wisdom that a particular thinker mistakenly accepts as broad, basic truths. We all want our own home team to win, so maybe that hope affects our ability to make objective predictions as to who will win an important playoff game. We'll see throughout this book that psychological research has shown many times that widely accepted conventional wisdom can be incomplete, biased, or just plain wrong. For example, people typically consider themselves to be free and independent thinkers who will always stand up for what they believe to be right. As we'll discuss in Chapter 13, however, scientists have been able to demonstrate that, when confronted by an authority figure or even just a small group of people with opposite views, many people go along with the higher authority or the crowd rather than follow their own beliefs.

> **biases** distorted beliefs based on a person's subjective sense of reality.

How might we avoid this sort of bias? Well we could start small and focused and build up to a big understanding. What if we made careful observations of how a number of teams do at home and away over the course of several seasons, and then use the total of home and away wins to decide if there is a *home arena effect*? Bacon argued that this type of approach, which proceeds in the opposite direction—from specific facts or observations to general ideas—would avoid bias. Such processes are called **inductive reasoning**. Here, thinkers use controlled direct observations to generate broad conclusions, and over time such conclusions are combined to achieve non-biased truths about the laws of the universe.

> **inductive reasoning** reasoning process proceeding from small specific situations to more general truths.

Psychologists using inductive reasoning would begin the search for natural laws by making **empirical**, or objectively testable, observations of mental processes and behaviours (e.g., things people actually do or think). Their cumulative observations would in turn lead them to develop **theories**, or big ideas about the laws that govern those processes and behaviours.

> **empirical** able to be tested in objective ways.
>
> **theories** ideas about laws that govern phenomena.

Today, inductive reasoning is still seen to be a key part of much scientific research. There are so many factors governing human behaviour, however, that if psychologists were to rely entirely on induction, or observation, they could never discover and specify all of the potential factors affecting human behaviour—the factors needed to generate accurate broad theories. Thus, to build on the best of both deductive and inductive reasoning approaches, psychologists today typically employ a blended model known as **hypothetico-deductive reasoning** (Locke, 2007; Sprenger, 2011). They begin with a deductive process: identifying a hypothesis.

> **hypothetico-deductive reasoning** process of modern science where scientists begin with an educated guess, perhaps based on previous research, about how the world works, and then set about designing small controlled observations to support or invalidate that hypothesis.

According to the famous philosopher Karl Popper (1902–1994), a sound scientific theory must establish, in advance, the observations that would refute it (Popper, 1963, 1959). In other words, a sound, properly organized theory runs the risk of being proven false. To test the soundness of their theories, researchers create **hypotheses**, specific statements that are objectively falsifiable (that is, they can be disproved). A physicist, for example, might generate a hypothesis based on a theory of weight and gravity, which states that objects of different weights will fall at different rates. If researchers (such as Galileo) were then to discover that cannon balls of different weights, when dropped at the same time from the same height, hit the ground at the same time, the hypothesis would be disproved and scientists would have to reconsider their theory of the relationship between weight and gravity (involving a standard rate of acceleration for all falling objects when air resistance is controlled).

> **hypothesis** a general statement about the way variables relate that is objectively falsifiable.

Similarly, in the hypothetico-deductive approach, psychologists set out to create controlled observations that will (or will not) support their hypotheses. In many cases, research results do indeed disprove their hypotheses. Psychologists may then reject or modify their theories and generate new hypotheses for further testing. Through repetition of this process, theories evolve over time to become more and more accurate explanations of human thought and behaviour. **Figure 2.1** outlines this approach.

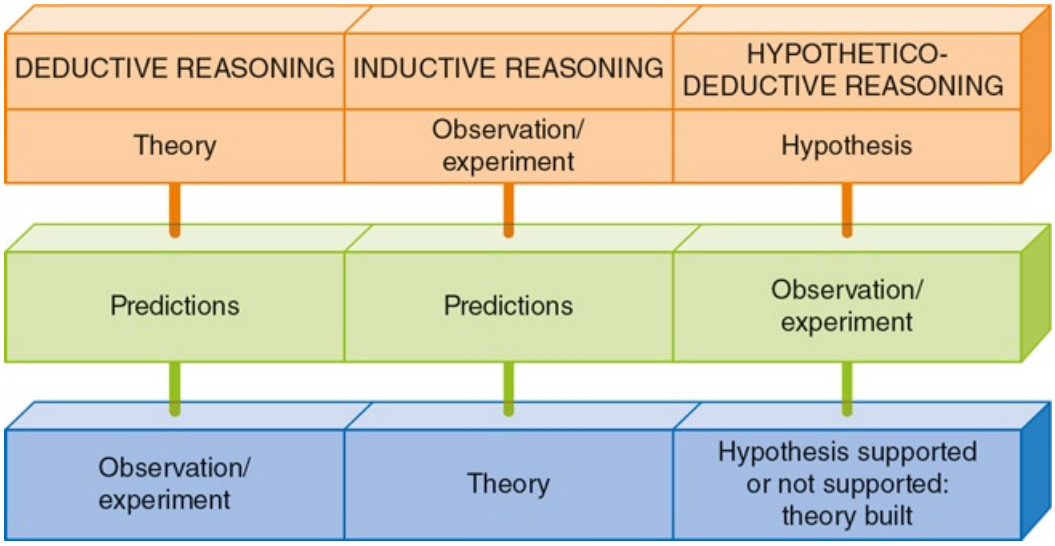


FIGURE 2.1 Reasoning and the scientific method Several different kinds of reasoning may be used as scientists carry out their work. Most psychological researchers use the hypothetico-deductive approach.

As we discussed at the beginning of the chapter, many people have ideas about whether watching violence on television causes people to exhibit more violent behaviour. To produce a scientific theory about the effects of televised aggression and violence, people would need to step outside their personal beliefs to avoid bias. A scientific approach would involve the steps described below:

Make observations. We might first examine what teenagers do after playing a video game containing virtual violence. For example, do they exhibit aggressive behaviour in social situations after playing *Call of Duty* for 2 hours? That is, do they engage in behaviours that suggest increased levels of aggression and violence?

Develop hypotheses. After making such observations, we would generate hypotheses about what led to the behaviour we observed. If the gamers acted more aggressively, for example, did the game's aggressive play cause players to think of their fellow human beings in a more negative light? Or were the players simply modelling themselves after the game characters? Whatever our explanation, we would generate a falsifiable hypothesis to test. One hypothesis, for example, might be that players increase their levels of aggressiveness in social interaction in response to spending 2 hours virtually interacting with violent game characters.

Test hypotheses. As we'll see in this chapter, there are several kinds of research studies we could conduct to see if this hypothesis can be disproved.

Build a theory. If the hypothesis is, indeed, disproved, we might modify or even throw it out and develop and test a new hypothesis. If our hypothesis that people who play *Call of Duty* change their behaviour to be more like the players in the game is not disproved, we might test it further. We might, for example, decide to study the players of a variety of video games (e.g., *Gears of War, Until Dawn,* or *Ether One*). If the results continue to support our hypothesis, the hypothesis can become a theory. A theory, in turn, can become a framework to generate additional hypotheses.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

1. What are the two core beliefs of a science?
2. What is the difference between inductive and deductive reasoning?
3. What is the difference between a hypothesis and a theory?
4. What is the hypothetico-deductive method?

What Do You Think? • Based on what you know about the scientific method, do you think psychology is a science in the same way chemistry, biology, and physics are sciences?

Is Psychology a Science?

LEARNING OBJECTIVE 2

Compare and contrast psychology with other natural sciences, such as biology, chemistry, and physics, and with pseudosciences, such as astrology.

As we saw in Chapter 1, prior to the nineteenth century, psychology was a field based largely on philosophy, religion, and even mysticism. With a rise in the popularity of animal research in the nineteenth century, however, scientists began to develop an increased interest in physiology and how human actions are tied to innate biological functions. Charles Darwin's theories on evolution, along with advances in the field of biology, raised questions about the interactions between humans and our environments. Given such roots, many credit the influence of biological science for shifting psychology from a philosophy toward becoming a science (Hergenhahn & Henley, 2013).

Although psychology is now defined as a natural science that uses experimental methods to study mental processes and behaviour, it does differ from the physical sciences, such as biology, in key ways, including how it pursues scientific goals and its role in influencing personal and social values. As well, there is a great deal of difference in how researchers withing Psychology approach their studies. Positive Psychology, for example, tries to expand Psychological theory and research beyond negative topics such a depression or anxiety to include positive concert like happiness. We will provide examples of Positive Psychology theory and research in all chapters and you can start by having a look at Positive Psychology 2.1.

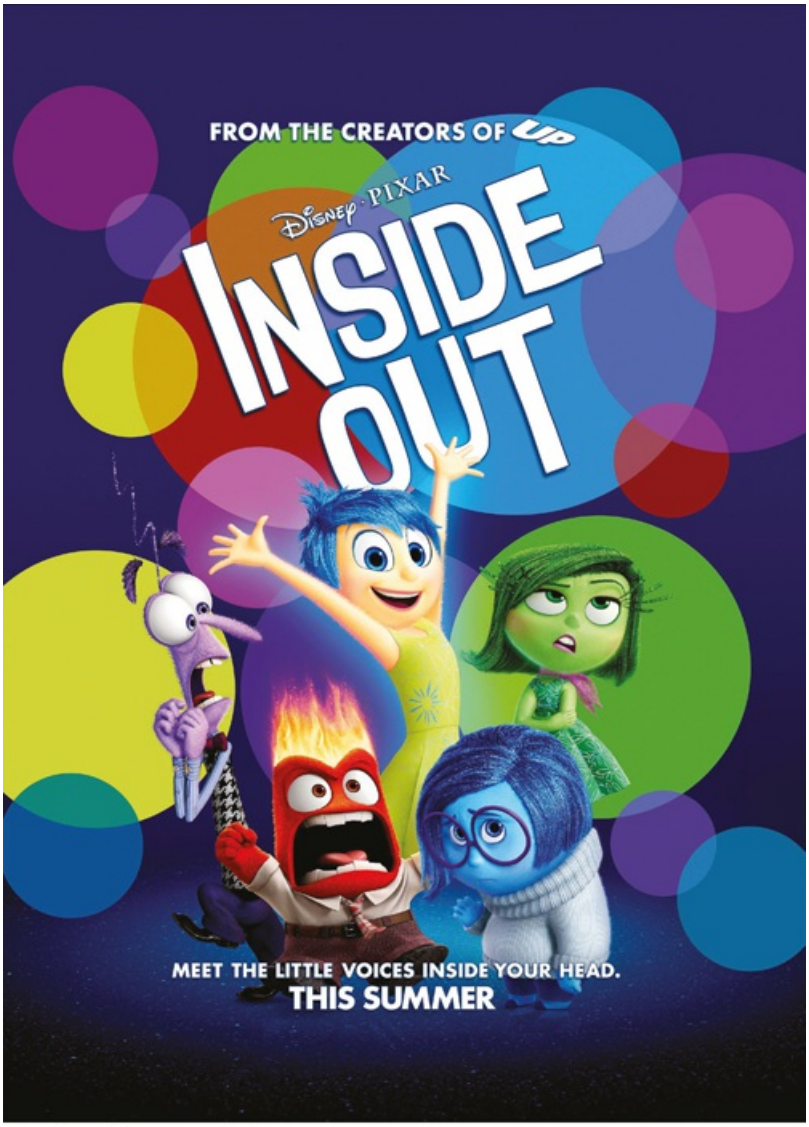
2.1 Psychology Around Us | Positive Psychology

Positive Psychology Is Booming but Is It All Science?

Martin Seligman and Mihaly Csikszentmihalyi are often credited with revolutionizing psychology in the late 1990s with their focus on the positive aspects of psychology, in contrast to the negative aspects of psychology where most psychologists focus their attention. (See more about positive psychology in Chapter 1.) Their work and the related work done by scientists over the last two decades has led to an explosion of research into the questions of how do we make our lives better and more fulfilling, and how do we follow our passions and find happiness. The publication of the books *Flow* by Csikszentmihalyi in 1990, followed over a decade later by Seligman's *Authentic Happiness* (2004), pushed positive psychology into the limelight.

Several associations around the world are now dedicated to positive psychology, including the World Congress on Positive Psychology held by the Positive Education Schools Association (www.pesa.edu.au) and the Positive Psychology Division 17 (www.div17pospsych.com) of the American Psychological Association, one of the largest psychological associations in the world. Many schools and military organizations have adopted positive psychology training approaches as part of their programs (Smith, 2019). This massive shift in mindset hasn't been without its negative side, however. Simply being happy may not make the challenging parts of your life, such as living in poverty, better. As well, the move toward more research in positive psychology has occurred in parallel with a booming industry of self-help books, blogs, and podcasts on the topic that critics point out are not always based on data collected in peer-reviewed, well-designed scientific experiments (Krafft et al., 2020). As a consumer it can be difficult to sort the science-based advice from that of "get happy quick" schemes. Positive psychology is sometimes critiqued for its "blame the victim" mentality, meaning that if you aren't happy it is somehow your fault (Frawley, 2015; Smith, 2019).

We will come back to the field of positive psychology in each chapter of this book. As you read these sections, keep in mind that this is a newly developing field that, like all areas of psychology, requires continued research efforts to understand. Ultimately, like in the Disney movie *Inside Out*, we do need happiness in our lives, but sometimes we may need a bit of sadness too.



AF archive/Alamy Stock Photo

All of our emotions are important **However, with psychology's historical focus on the negative aspects of emotion and human behaviour, the developing field of positive psychology brings more balance to the study of what makes us human.**

Goals of Psychology

As we saw in Chapter 1, all sciences share the goals of describing, explaining, predicting, and controlling the phenomena they study. However, the emphasis each field places on these goals may vary. One key difference between psychology and the physical sciences, for example, is in the area of description. A core goal of many physical sciences is to isolate and describe the smallest elements that contribute to a larger whole. Biologists look at how a cell contributes to the overall functioning of an organism, for example. Chemists and physicists examine how atoms and subatomic particles make up the structure of, well,

everything. Although psychology also attempts to isolate fundamental elements of behaviour and mental processes, psychologists face an additional task because behaviour is determined by many such factors simultaneously.

The basic factors that affect behaviour can be temporary or permanent fixtures in a person's life. The atomic structure of gold, for example, is the same in all gold all over the world, but a complex behaviour, such as reading this textbook, cannot be broken down into a standard set of elements that work the same for every person. The reading behaviour of a student might be influenced by a temporary factor, such as anticipation of an upcoming exam, which does not affect the reading behaviour of non-students. The idea behind psychological research is both to *isolate* the relative contribution of such factors and to think about how these factors *come together* across different situations to influence human behaviour (see photo).

Allison Joyce/REUTERS / Newscom

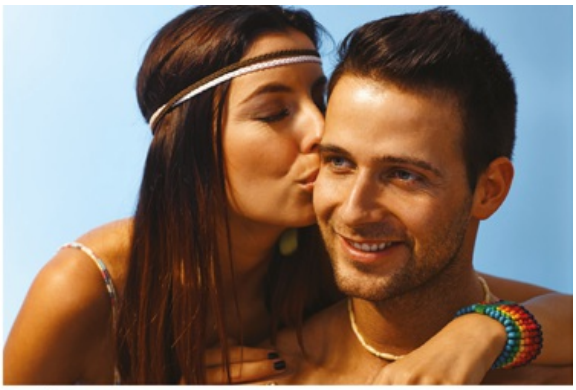
Multiple influences **Behaviour is complex and is determined by many factors operating simultaneously. What different factors—temporary, permanent, or both—might be influencing each of these people to take part in a Polar Bear Club swim?**

Psychologists face an additional challenge because much of what they study does not have a clear and observable physical reality like the basic units of study in other scientific fields. With the help of special tools, scientists in those fields can observe even the tiniest bits of matter, including atoms and DNA. Of course, this is also true of psychology *to some degree*. Behaviours, sensations, or physiological responses, for example, can be directly observed, measured, and explained. In his review of science, the great German philosopher Immanuel Kant suggested that when studying phenomena such as these, psychology is indeed empirical and very close to a "real" science (Kant, 2003). Other psychologists, such as the behaviourist B. F. Skinner, also advocated this view of psychology. In fact, as we saw in Chapter 1, many behaviourists have stated that, as scientists, psychologists should study *only* what is directly observable.

On the other hand, as Kant himself observed, many of the processes that form the basis of psychology cannot be observed or described directly. We have no microscopes or tests that

will allow us to see a thought or an emotion, for example, with the same clarity as a cell. Granted, good scientific work and sound experimental study have enabled us to look at many of the ways thoughts and feelings can influence behaviours, and psychologists are always seeking out new ways of objectively defining these and other elusive features of mental functioning (see photos). But direct observation continues to be a difficult task in the field of psychology.

fotostorm/Getty Images



nyul/Getty Images

Thoughts versus behaviours **Thoughts cannot be observed directly, but behaviours can. Thus, psychologists can be more certain about the romantic feelings of the woman on the right than those of the woman on the left.**

Values and the Application of Psychology

Psychology is also distinct from other scientific fields since it deals in major ways with issues associated with values, morality, and personal preference—issues that historically were addressed exclusively by spiritual and political leaders. Like all scientists, psychologists try to provide society with useful information that has practical applications. But people are particularly inclined to use psychological information to decide issues that overlap with philosophy, religion, the law, and other such realms of life. For example, on its website (www.cpa.ca), the Canadian Psychological Association offers policy statements based on psychological research on topics ranging from the death penalty (studies show it does not reduce homicide rates), bullying (research shows solutions require relationship changes), and physical punishment of children (findings indicate it is an ineffectual way of controlling or shaping a child's behaviour and it models aggressive behaviour for the child).

Of course, other sciences also influence the values and ethics of human beings to various degrees. The field of genetic research, for example, was pioneered by biological scientists who were looking for better farming practices (see photo). However, some early geneticists soon came to believe that selective breeding could be applied to humans to increase the likelihood of desired offspring or to decrease the likelihood of undesirable offspring. Their research contributed to a perspective often referred to as social Darwinism and to a field eventually known as eugenics, a social movement that advocated improving the human race by encouraging reproduction by people with desirable genetic traits and discouraging (sometimes through forced sterilization) the reproduction of people with undesirable traits (Osborn, 1937). This movement is most readily associated with actions of Nazis in Germany in the years leading up to and into the Second World War that contributed to the "Final

Solution" or Holocaust (Lindert et al., 2012). However, eugenics was influential in North America as well and influenced not only many people's personal childbearing decisions, but also contributed to policies of governments and social agencies in some locations that required forced sterilization surgery for people deemed unfit to reproduce due to being "feebleminded" (Sofair & Kaldjian, 2000; Tanner, 2012). Angus McLaren (1990), of the University of Victoria history department, points out that in Canada, the province of Alberta established a eugenics board in 1927 to rule on involuntary sterilizations; it was not disbanded until 1972. Similar steps were taken in Ontario though without legislative support for sterilization (Koester, 2016). Indeed, eugenics has often been associated with ableism, racism, and homophobia (Hutcheon & Lashewicz, 2020).

VCG/Getty Images

Happy birthday! Yangyang, a female goat cloned by Chinese scientists in 2000, wears a wreath at her sixth birthday party. Advances in genetic research and genetic engineering hold much promise, but it is important to consider the ethical implications.

Today, the field of genetic research sparks concerns and debate about food practices, stem cell research, human cloning, and other such issues. Every scientific field must wrestle with questions of how to ethically apply the knowledge it discovers about the world, but few more so than the field of psychology. In addition, few sciences are as plagued as psychology is with popular imitations and misrepresentations of their work.

Misrepresentation of Psychology

It is natural for people to seek guidance periodically on how to live their lives. And psychologists certainly do not shy away from helping people with their problems, as evidenced by the thriving areas of clinical and counselling psychology and other applied disciplines described in Chapter 1. Ultimately, however, science—even psychology—cannot answer fundamental and subjective questions about human nature, such as what are people basically like.

People who claim to do so are misrepresenting the science of psychology with

pseudopsychology (Fasce, 2018). Pseudopsychology, or *pop psychology*, is not based on the scientific method, yet it takes on the appearance of science. Some types of hypnosis and "clinical treatments" involving crystal therapy are examples of pseudopsychology. Pseudopsychologists often have hidden goals, such as promoting certain moral or religious values (Hergenhahn & Henley, 2013). A fundamental difference between pseudopsychology and psychology is that psychology does not claim to address all human issues, whereas pseudoscientists argue that psychological principles can provide the answers to all of life's major questions (Goodwin, 2015).

Clearly, psychologists must maintain a difficult balance. On the one hand, it is important to encourage the human drive to seek guidance and derive meaning about how to live effectively (see Psychology Around Us 2.1). On the other hand, psychology must distance itself from pseudoscience to maintain its status as a natural, empirically based science. As one researcher wrote, "Mainstream psychologists have a problem differentiating themselves from what they regard as a pseudoscience without seeming dogmatically intolerant" or narrow minded (Henley, 2019, p. 618). It is essential that we think critically and scientifically about all claims being made about human behaviour and the factors that direct human actions.

2.1 Psychology Around Us

Making Psychology More Popular

Courtesy of Dr. Stanley Coren

Stan Coren

Within many scientific disciplines, charismatic researchers and practitioners are able to describe their complex topics so that almost anyone can understand the concepts. These individuals present facts about science in ways that engage the public's imagination. As a result, some of them become well-known figures in the popular media, such as in mass-market books, magazines, television, and radio. Psychology has its share of such individuals.

Fraser Mustard (1927–2011) was a Canadian physician who, during a long career at McMaster University, was involved in establishing its unique problem-focused approach to medical training. After retiring, he became internationally known for his

work on the *Early Years Study* and as an advocate for the critical importance of the first six years of life in establishing children's intellectual potential and future achievements (McCain & Mustard, 1999). His work led to the expansion of many early education programs, improving developmental outcomes for Canadian children (Komro et al., 2011).

Another well-known researcher is psychologist Brenda Milner, Ph.D., who trained under another well-known Canadian cognitive psychologist, Donald Hebb. Milner specializes in brain functioning (frontal lobes and lateralization). As well, she has pioneered work into spatial memory and language using recently-developed brain imaging techniques. Milner has been recognized for her work by being made a member of the Royal Society of Canada and the National Academy of Science (in the United States), as well as winning the Swiss international Balzan Prize for Cognitive Neurosciences.

And then, of course, there are the celebrity practitioners—professionals who are very well known to the public as book authors or from work on radio and television. Some of these practitioners are well trained and have appropriate professional credentials. Stan Coren, a cognitive psychologist at the University of British Columbia, has written one of the most used textbooks on sensation and perception (Coren, Ward, & Enns, 2004). As well, he has written widely read books on handedness (1993), the effects of sleep deprivation on everyday life (1996), the psychology of visual illusions (2020), and many books on the intelligence, behaviour, and role of dogs (1997, 1998, 2001, 2003, 2006a, 2006b, 2008a, 2008b, 2010a, 2010b, 2012, 2014, 2016), in addition to hosting a Life Channel show on dog behaviour called *Good Dog*!.

But a critical thinking tip! For each Coren, who is well qualified, there are many more celebrity practitioners who do not have proper training or appropriate credentials in their supposed areas of expertise, including some of the media's most popular TV and radio advisors. Before listening too closely, it is always best to check the qualifications of a psychologist or other professional who is dispensing advice on radio, television, or the web, or take some time and look into whether they actually have *scientific* research support for their claims.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

5. What are the four goals of psychology?

6. What is the main difference between psychology and pseudopsychology?

What Do You Think? • Why do you think that pseudopsychology appeals to so many people even though it is not based on science and does not reflect the truth?

How Do Psychologists Conduct Research?

LEARNING OBJECTIVE 3

List steps in the research process and key characteristics of descriptive and experimental psychological research methods.

ANIMALS ANIMALS/National Geographic Stock

Observation **Watching rats run through mazes is only a very small part of how psychologists conduct research.**

Let's go back to the controversy over violent video gaming and aggressiveness. Suppose that you frequently play *Call of Duty* or another combat-based game. Let's say that after a long gaming session, you notice that you drive a bit more aggressively. You wonder whether all people who play that game become more aggressive than those people who do not. How would you, as a psychological researcher, study this question?

As we described earlier, the scientific method begins with observation (see photo). So, after noting your own reaction, you may decide to observe other gamers. Maybe you get together with some friends, rather than meeting online for a gaming session, and you watch how everyone interacts with each other during and after the game play—though you will have to be aware of influences other than the game if, for example, everyone is drinking!

State a Hypothesis

After you've made such observations of yourself or others, you need to generate a prediction; this is your research hypothesis (see **Figure 2.2**). As we have noted, a hypothesis defines what you think will happen and states your prediction in a way that can be tested and found to be either true or false. Your hypothesis might be: playing a violent video game typically increases players' aggressive behaviour.

Notice in the way you state your hypothesis that you are saying that one thing results in another thing. The two things are called *variables*. A **variable** is a condition or event or

situation—it can really be many things. In psychological research a condition or event that is thought to be a factor in changing another condition or event is known as an **independent variable**. We call it the independent variable because it is the one the researcher carefully sets and controls the level of to see what changes it will cause through its independent actions on other variables. In this study, playing or not playing a violent video game such as *Call of Duty* is an independent variable. A researcher could also change the nature of this variable to see how it affects aggressive behaviour. Aggressive behaviour (we could look at physical aggression or verbal aggressiveness) would be a **dependent variable**, the condition or event you expect to change as a result of varying the independent variable. It is the dependent variable because if our hypothesis is correct, then people's scores on this variable will "depend" on their specific exposure to the independent variable.

> **variable** condition, event, or situation that is studied in an experiment.
>
> **independent variable** condition or event that is thought to be a factor in changing another condition or event.
>
> **dependent variable** condition or event that you expect to change as a result of variations in the independent variable.

How about another example? If you wanted to see if drinking an energy drink would help you read more pages of your textbook in an hour of studying, you could read for an hour without any energy drink, drink one energy drink and read for an hour, then drink a second energy drink and read for another hour. You could count the number of pages you read in each of the 3 hours. So in this study, what is the independent variable? (It is the amount of energy drink consumed.) What is the dependent variable? (If you thought "pages read," you are right.) Of course, just counting pages read tells you nothing about how well you have read them or what you will recall later from what you have read as you write the exam. We turn to this sort of issue next.

In addition to defining these variables, you also have to **operationalize** the variables—develop very precise definitions of the independent and dependent variables that allow you to measure and test them (McGrath, 2011). What exactly (and measurably) do you mean by "playing *Call of Duty*" and what, again, exactly and measurably, do you mean by physical or verbal aggressiveness? In this case, you might define the independent variable as the length of time players spend playing the game. As a researcher, you may require the participants in your study to play for an hour or for 3 hours or even play several different games over a period of time. In our previous example, we operationalized stimulant drink use as zero, one, or two cans, but we could have operationalized it as zero, half, one, one-and-a-half, or two cans (note that according to the manufacturers, you are not supposed to drink more than two cans of energy drink a day).

> **operationalize** to develop a working definition of a variable that allows you to test it.

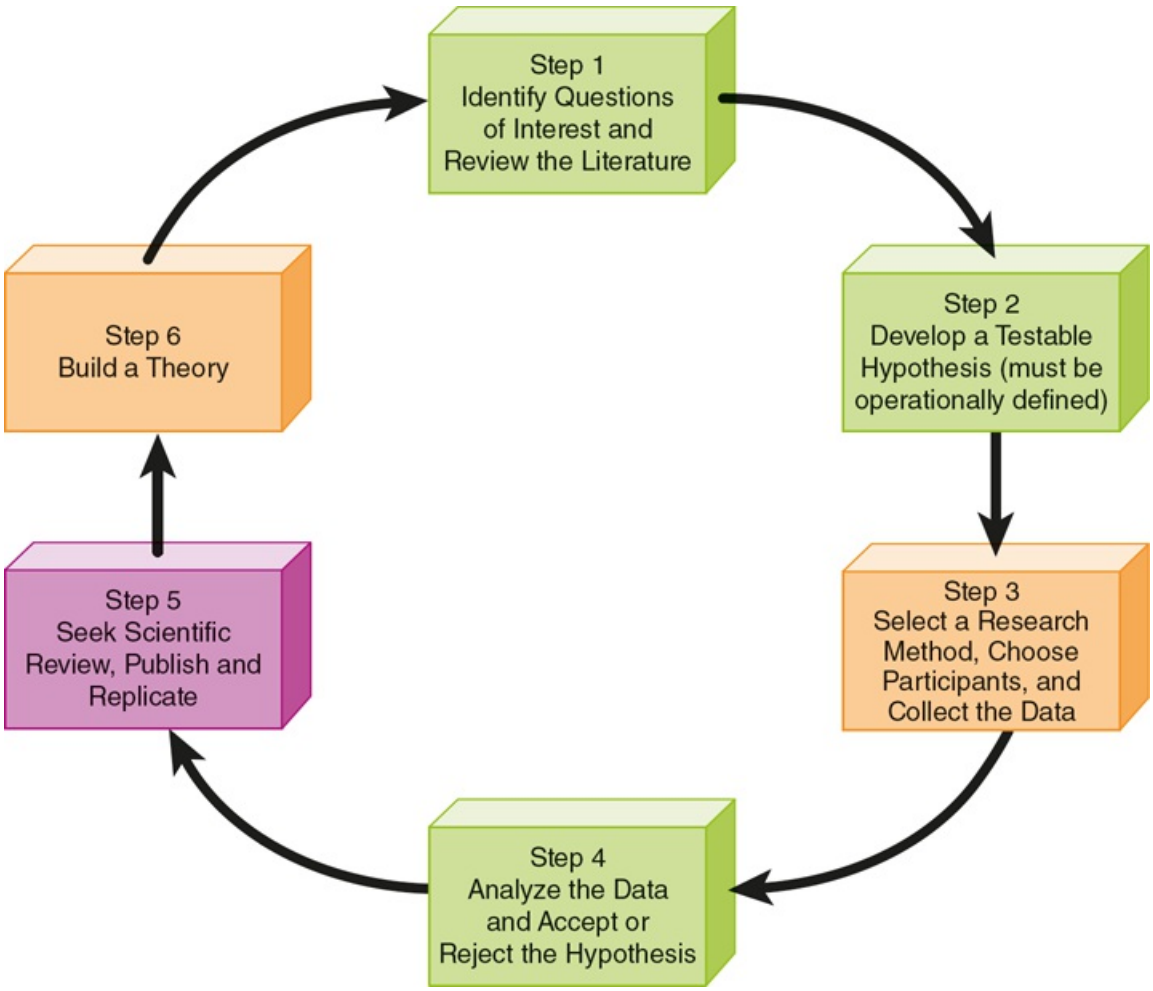


FIGURE 2.2 How do psychologists conduct research? Psychologists follow certain steps and confront a number of choice points as they study questions about mental processes and behaviours.

While it may be relatively easy to create an operational definition of playing *Call of Duty*, it is harder to operationalize the dependent variable in this study, aggressive or violent behaviour. You might have participants fill out a questionnaire asking about their feelings of anger or hostility and their intentions for managing a number of hypothetical situations (such as being cut off in traffic). If you did this, however, you would not know for sure that the attitudes and intentions stated on the questionnaire would reflect or lead to aggressive behaviour. People may think a lot about behaving aggressively without actually doing so. Thus, you might prefer to have participants in your study demonstrate some kind of actual aggressive behaviour. You could, for example, set up a situation in which each participant spends 30 minutes playing an online game involving potential aggression or violence against one or more other study participants. Even here, however, you would not be sure that your operational definition of aggressive behaviour is on target. You might not be measuring "true-life" behaviour; the participants might be altering their research behaviour because they know they are being watched or monitored or because they know they are playing a game that is not real.

There are yet other ways researchers could operationally define aggressive behaviour—perhaps involving verbal aggression or self-criticism. Each definition would have advantages and disadvantages, and each would have implications for the conclusions the researchers could draw. In our other example, we counted pages read as our dependent variable, but can you think of any problems with that? One possible issue might occur if after two energy drinks people read a lot more pages but do not later recall much of what they read. This would suggest a problem with your operationalization if the dependent variable you were interested in was studying success. We cannot answer all of these questions in a simple study. This is why many research articles conclude with some version of the statement "more research is required."

Choose Participants

Once you have identified your variables, you need to select the people who will participate in your study. It isn't feasible for researchers to go out into the world and study the entire population of people whose behaviour interests them. Indeed, a population of interest could sometimes include everybody in the whole world. Even when psychologists are not interested in the entire human population, their populations of interest may be very large groups, such as all Canadians, adults, teenagers, children, men, or women (see photo). In your gaming violence study, the population of interest could include everyone who plays violent video games and everyone who doesn't play them at all or who plays them to a lesser degree.

Because they cannot study an entire population, researchers must obtain a test subset, or **sample**, from their population of interest (McGrath, 2011). This subset is carefully selected and stands in for the population as a whole so that the results obtained from the sample, if gathered and treated properly, might suggest some things about the general population. Population sampling of this kind is used very frequently. Political pollsters, for example, interview samples of the voting population to predict which candidate will win a national, provincial, or civic election, although the poor performance of political polls based on samples of voters in recent elections suggests that the upsurge in cellphone use and other factors are making it difficult to obtain representative samples of voting populations (Nelson, 2019). The NDP win in the 2015 provincial election in Alberta contradicted a number of poll predictions, as did the success of Justin Trudeau's Liberals federally in 2015 (Gidengil, 2012; White, 2016).

> **sample** the group of people studied in an experiment, used to stand in for an entire group of people.

HamidEbrahimi/Getty Images

Proper sampling **Which of the people in this photo should be included in a study? All of them and others too, if a researcher wants to draw conclusions about the entire population. Only some of them, if the researcher seeks to understand just a certain age group, just women, or other subgroups.**

In most instances, researchers prefer to obtain their samples through **random selection**. Random selection is simply a fancy term for choosing your participants in such a way that everybody in the population of interest has an equal chance of becoming part of the sample. That way, you can minimize *sampling biases*—that is, you will not inadvertently select a group that is especially likely to confirm your hypothesis (such as people who game for 8 to 12 hours a day or not at all). If you include only your gaming friends in your sample, the study probably will yield very different results than if you include only people opposed to the sale of violent video games. Indeed, neither sample would be fully representative of the population at large.

> **random selection** identifying a sample in such a way that everyone in the population of interest has an equal chance of being involved in the study.

Truly random selection can be elusive. The members of your population who do not play video games include, for example, 3-year-olds, who probably are not interested in gaming (yet!) and probably are not capable of making the same kinds of choices about aggressive behaviour that 18- or 25-year-old persons might make. Thus, you may decide to narrow your sample to include adolescents or young adults only. Of course, such a choice would mean that your findings will be relevant to adolescents or young adults only, rather than to adults or to the entire human population. Researchers in psychology often try to choose samples that make their results relevant to the broadest possible segments of their populations of interest.

Pick a Research Method

Researchers have several options when designing studies to test their hypotheses (McGrath, 2011). Research methods differ in their goals, samples, and the ability of researchers to generalize their results (suggest that they might apply) to a population. Most of the methods we describe next, including case studies, naturalistic observation, and surveys, are known as **descriptive research methods**. They allow researchers to pursue the goal of description: to determine the existence (and sometimes the strength) of a relationship between the variables of interest. In addition to such descriptive methods, we will also describe *experiments*, which allow researchers to explain the *causes* of behaviour (see **Figure 2.3**). Understanding the differences between descriptive, also called correlational, studies and experimental studies, and particularly understanding what each can or cannot say about the causes of the behaviour each observes, is critical to properly understanding psychological research.

descriptive research methods studies that allow researchers to demonstrate a relationship between the variables of interest, without specifying a causal relationship.

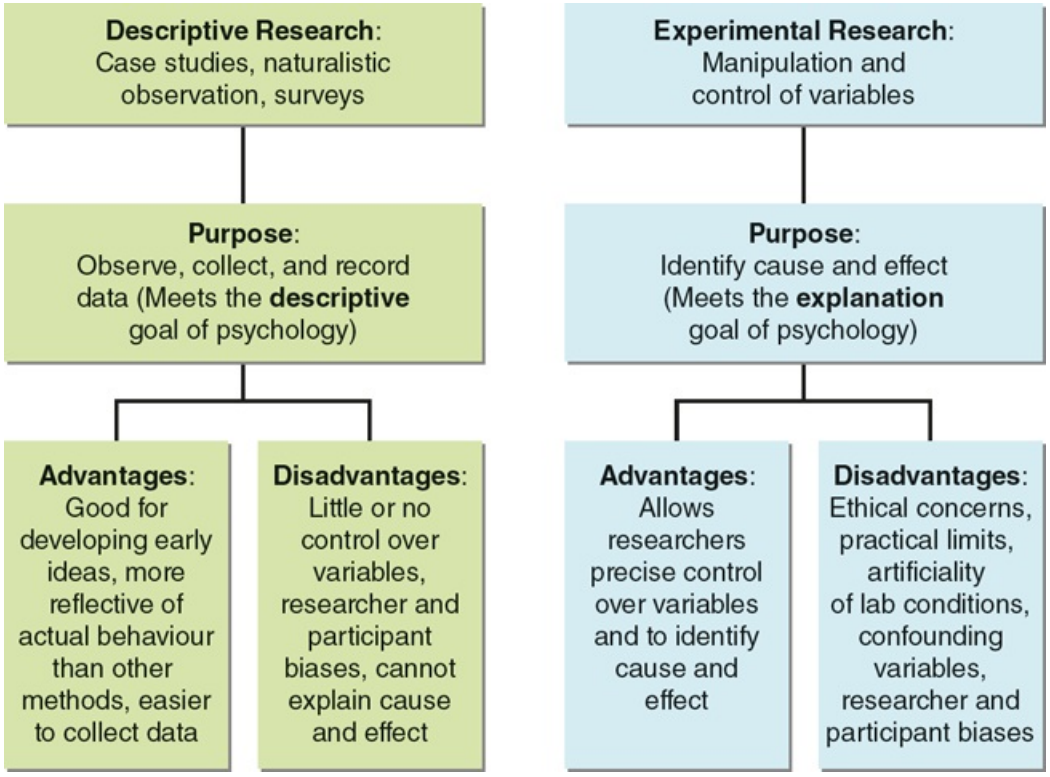


FIGURE 2.3 Descriptive versus experimental research Because descriptive methods and experimental methods each serve particular purposes and have different advantages and disadvantages, psychological research includes both kinds of approaches.

Adapted with permission of John Wiley & Sons, Inc., from Carpenter, S., & Huffman, K. (2012). *Visualizing Psychology*, Third Edition. Hoboken, NJ: Wiley, p. 15.

Case Studies

A **case study** focuses on a single person. Medical and psychological practitioners who treat people with problems often conduct case studies to help determine whether therapeutic interventions affect their client's symptoms (George, 2019; Lee, Mishna, & Brennenstuhl, 2010). A case study can be a good resource for developing early ideas about phenomena. One disadvantage of a case study, however, is that it can be affected greatly by *researcher bias*, which occurs when researchers see only what they expect to see in their studies. Some clinician/researchers may, for example, note only the healthy behaviours of persons after they have provided treatment to those individuals. Another disadvantage of case studies is that researchers cannot confidently generalize to other situations from the study of a single person (Lee et al., 2010). Suppose, for example, that you conduct a case study to test your hypothesis that playing violent video games increases aggressive behaviour: you closely observe one fellow student who plays such a game, and you find that he later reports himself to be non-violent and gentle, even when frustrated by the behaviour of other drivers while driving. Your case study observation might indicate that your hypothesis is worthy of further research, but without a larger number of comparison participants, it is impossible to say much about other players of the game. You would not know whether this person's behaviour after playing the game is the norm or an exception.

case study study focusing on a single person.

Naturalistic Observation

In **naturalistic observations**, researchers watch as unobtrusively as possible while people behave as they normally do, similarly to how Jane Goodall observed troops of chimpanzees living in the wild or how Dian Fossey studied mountain gorillas. Researchers often make naturalistic observations of children in schools or daycare centres (see photo). As a researcher, perhaps you could go into participants' homes over multiple weeks and see whether they watch hockey games at all. You could then observe whether those people who watch games engage in more aggressive behaviour and whether those who don't watch behave less aggressively. Naturalistic observations have the advantage of being more reflective of actual human behaviour than most other research designs.

naturalistic observation study in which researchers directly observe people in a study behaving as they normally do.

Photo by Robert Barclay courtesy Larissa Niec

A first-hand look Unlike case studies or surveys, naturalistic observations enable researchers to directly observe people in their natural settings. Here, for example, a psychologist observes a preschool classroom through a one-way mirror.

A disadvantage of this type of research, however, is that naturalistic observations can be subject once again to researcher bias—observers may notice only what they expect to see, and there is often no one else observing at the same time so that observations can be compared (Goodwin, 2011; Lindahl, Malik, & Wigderson, 2019).

Another potential problem with naturalistic observation is that the mere presence of a researcher or even a video camera in an otherwise natural environment can change the behaviour of the participants. The next time you are walking past an elementary school at recess, look for the "duty teacher" on the playground and then look to see if the children in front of the teacher are behaving differently than those behind and out of the teacher's line of sight. Many people become nicer or more considerate when they are aware that they are being watched, for example. This problem was first identified in the psychological literature by Landsberger (1958) in his study of the productivity of factory workers. In his studies, he found that the workers' productivity increased whenever changes to the workplace were implemented, regardless of what type of change was imposed. For example, lowering or brightening the lights in the factory both resulted in productivity increases. Landsberger suggested that this increase in productivity occurred because the workers were motivated to perform better because they knew that they were being observed. This phenomenon has since been termed the **Hawthorne effect** (Goodwin, 2011) because the study was conducted at the Hawthorne plant of Western Electric near Chicago.

Hawthorne effect what happens when people who are being observed in studies or at their workplace improve or change some of their behaviour simply because they are being watched or studied, not in response to an experimental manipulation.

Many of the potential problems with naturalistic observation can actually be effectively addressed. Multiple observers can be used to control for individual observer bias by comparing observations across several observers. Observers can be used who are not informed about the specific hypothesis under investigation, thus limiting opportunities for bias to affect their observations. Observers can spend a lot of time in the setting they wish to observe so that they become an accepted part of the setting and their presence does not disrupt usual behaviour.

The sophistication and wide use of smart phones and related social media tools have hugely expanded the ways in which naturalistic data can be gathered. Work examining the day-to-day behaviours of medical patients using random requests for data about people's activities and well-being via their cellphones has produced rich data regarding symptom fluctuation and treatment compliance. It has also provided opportunities for individual adjustments in treatment, leading to improved medical condition management (Abraham et al., 2016; Kaplan & Stone, 2013). Clinical and research psychologists have picked these tools up by way of work in health psychology. Cellphone tools have been used to gather naturalistic data on mental health and treatment effectiveness (Emmelkamp et al., 2014) for a variety of applications. The data can be used to assess clients' moment-by-moment needs for disorder-related support or treatment, to deliver treatment-related reminders and suggestions (Nahum-Shani, Hekler, & Spruijt-Metz, 2015), and to gather real-world data on employee stress, health, and well-being (Ilies, Aw, & Lim, 2016). As we will see in later chapters, some of psychology's most important studies were descriptive studies involving naturalistic observation. Positive psychology is a recently established area of theory and research in psychology that makes use of both experimental (qualitative) and descriptive (qualitative) research methods. See how both approaches are helping to expand our understanding of how things go well for us in the Positive Psychology 2.2.

2.2 Psychology Around Us | Positive Psychology

The Impact of Positive Psychology on Psychological Research

According to Veronika Huta, founder of the Canadian Positive Psychology Association (www.cppa.ca/), the field of positive psychology has pushed psychologists to incorporate a wider variety of research methods (Huta, 2016a). While quantitative methods will always be the basis of psychological research, the use of qualitative methods is becoming more common, and the mixture of quantitative and qualitative research methods is giving us a deeper look into the subjective experience of human beings.

This new focus on research questions in positive psychology has pushed many psychologists toward expanding our research in areas such as hedonia, the study of pleasure and the absence of distress, and eudaimonia, the study of personal growth, authenticity, and excellence (Huta & Waterman, 2014). It is likely the combination of hedonic and eudaimonic aspects of our psychological makeup that is critical for our

ultimate happiness. How these two concepts define our individual experiences of emotion, our motivations, and ultimately our mental health is of increasing interest to psychologists and researchers. Aspects of positive psychology, and how we feel about ourselves and grow toward our full potential, also have an impact on how we interact with others, our society as a whole, and the environment we live in (Huta, 2016b). The focus of positive psychology research pushes psychologists to not only look for how things go wrong in our lived experience (see Chapter 15), but also how things go right, and how we can find a balance between the hardships we all face and the good things that give us joy, peace, and happiness to make our lives worth living.

Aleksandar Kosev/123 RF

Revolutionizing the study of psychology **Much of psychology has focussed on the negative aspects of human experiences such as depression and anxiety. Positive psychology researchers are trying to round that out by studying more positive concepts like the nature of happiness.**

Surveys

A third descriptive approach, frequently used in psychological research, is the **survey**. In a survey, researchers ask people a series of questions. Researchers can conduct surveys in person; via telephone, email, or online; or with a written questionnaire. To test your aggressive behaviour hypothesis, for example, you might design a questionnaire that asks people about their *gaming* habits and about their aggressive attitudes, and use their answers to determine whether or not a relationship exists between the two variables.

survey study in which researchers give participants a questionnaire or interview them.

The advantage of a survey approach is that surveys allow researchers to obtain information that they might not be able to gather using case studies or naturalistic observations. It might be hard, for example, to tell whether a person in a case study is avoiding aggressive behaviour because he wishes to do the right thing, or whether the individual is avoiding

aggressive behaviour to get some kind of reward. A survey can help pin down such issues. Another reason surveys are sometimes favoured by psychologists is that they can also provide data that enable researchers to measure how strong the relationship is between two variables of interest.

Surveys do suffer some disadvantages, however (Coolican, 2017; McGrath, 2011). Their data can be unreliable because people frequently answer in ways that are socially acceptable rather than in ways that are reflective of their true attitudes, a problem known as *participant bias*. Thus, people in your gaming study may describe themselves on a survey as less aggressive than they actually are because they know that being aggressive is considered a socially inappropriate trait. Similarly, participants in a survey study may be unaware of just how aggressive they are. Also, we cannot be certain that all participants understand all the survey questions the same way. For example, some people might interpret a question about whether other drivers frustrate them as applying only if another driver makes them really angry, while others might assume we mean any small annoyance is frustrating. Although subject bias obviously is a common concern for survey researchers, it can occur in experiments and other types of research as well, as we shall soon see.

Another problem is that survey data cannot tell us decisively about the *direction* of the relationship between variables. Do people who play a lot of violent video games become more aggressive, or are highly aggressive people drawn to play a lot of violent video games? A survey can suggest answers to this question but cannot confirm them.

The use of surveys and other research methods presented on the Internet has increased significantly in recent years. Online surveys have their own advantages and disadvantages over standard paper and pencil or face-to-face surveys. On the plus side, online surveys save paper, reduce or eliminate the demands of data entry, produce cleaner data by checking responses as they are entered, can change the questions respondents see depending on how they answer other questions, and can provide immediate feedback to participants. Online surveys can reach larger and more diverse samples of people, providing data that was previously difficult or impossible to obtain (Gosling & Mason, 2015).

On the downside, researchers may be concerned about how honestly or reflectively people are answering their online questions, which is a problem with paper surveys as well. In addition, there are concerns that Internet samples may not be sufficiently diverse to be representative of larger populations. This is especially of concern if researchers are interested in groups, such as the elderly, who are not particularly e-savvy (Gosling et al., 2004). The degree of anonymity provided by the Internet reduces some ethical concerns but raises others. For example, researchers cannot be aware of or provide assistance if participants become upset by some part of their survey experience (Gosling & Mason, 2015). New areas of inquiry have been made possible by the Internet providing access to widescale data sets, called “Big Data.” For example, one study used the vast data from Facebook to examine voting behaviour (Bond et al., 2012). As noted in the section above on naturalistic research methods, smart phone apps and sensing technologies can produce very rich data on people’s day-to-day and moment-by-moment psychological experiences (Miller, 2012). The future of surveys and other Internet-enabled research methods looks very bright indeed!

Experiments

If you want to know what *causes* what, you have to design an experiment (Coolican, 2017; McGrath, 2011). An **experiment** is a controlled observation in which researchers manipulate levels of one variable—the independent variable—and then observe any changes in another variable—the dependent variable—that result from their manipulation.

> **experiment** controlled observation in which researchers manipulate the presence or amount of the independent variable to see what effect it has on the dependent variable.

One way of experimentally testing your violent gaming hypothesis in this kind of study would be to divide your sample into two groups: an **experimental group** and a **control group**. An experimental group is the one exposed to the independent variable. In our example, the experimental group would consist of people who are instructed to play several hours of a violent video game. A control group, in contrast, consists of people who are similar to those in the experimental group but who are not exposed to the independent variable—for example, people not instructed to play a game at all or to play a non-violent game. By comparing the aggressive behaviour of the two groups after one group plays a violent game and the other does not, you might conclude with some degree of confidence that differences in aggressive behaviour are caused by playing the violent video game. You could also create a more complex experiment, in which multiple experimental groups game for varying amounts of time, or where some play games that involve high levels of violence while others play less violent or completely non-violent games. You could then compare them with the non-playing control group participants to determine whether the amount of gaming or the type of games being played affects levels of aggressive behaviour.

> **experimental group** group that is exposed to the independent variable.
>
> **control group** group that has not been or will not be exposed to the independent variable.

Many psychology experiments involve different levels of the independent variable of interest, as such higher levels of design complexity better match the real-world reality we are trying to study. For example, we could set up our study so that the experimental groups either played a little or a lot of more or less violent games. This sort of design allows us to look for *interaction effects*. It may be that playing a small amount of a violent game has no effect on aggressive behaviour, while playing a lot of it does increase aggressive behaviour. This sort of interaction effect could be observed and reported using this more complex experimental design.

The composition of experimental and control groups needs careful attention. In our example, no one in the control group games at all (see **Figure 2.4**), and none will be instructed to do so for the study. But what about the experimental group? Should you include people who have played the game previously or regularly? Or should you begin with a group of participants who—like the control group—have never played the game, and then expose the experimental group to a marathon of gaming? Either approach is acceptable, but the two approaches may lead to different conclusions.

Other kinds of differences—past or present—between the experimental and control groups may also influence the results of an experiment. What if more people with gaming experience or with emotional control issues (bad tempers) ended up in the control group than in the experimental group? That could affect the results of your study. You could carefully ensure that the groups are equally balanced on all variables you can think of that might affect the results, but you can never think of them all. Researchers deal with this problem by using **random assignment** to make sure that everyone in their sample has an equal chance of being in either the control or experimental group and that (assuming reasonably large sample sizes) the groups are likely to be equally balanced in terms of *any* factor or variable that could influence results other than the independent variable (Remler & Van Ryzin, 2015). Ideally, random assignment controls for all such factors so that you can say with more confidence that any differences you find are likely due to your manipulation of the independent variable. Even so, researchers still run the risk that the groups will differ in some important ways. Suppose that you randomly assign gaming participants to each of your groups, but nevertheless wind up with more males in one group and more females in the other group. Such an unintended group difference may affect the participants' subsequent aggressive behaviours and so may lead you to draw incorrect conclusions. Some researchers pre-interview or give questionnaires to participants in both the experimental and control groups to make sure that the groups are comparable to one another, especially in terms of variables the researcher is concerned could make a big difference in the results. Their goal is to increase the likelihood that whatever effects emerge in the study are caused by the experimental manipulation of the independent variable and are not attributable to other, pre-existing variables, such as income level. If the groups are fairly large, random assignment will largely take care of these group membership concerns.

> **random assignment** assigning individual research volunteers to experimental and control groups using a random process so that uncontrolled variables are randomly or evenly distributed across all groups.

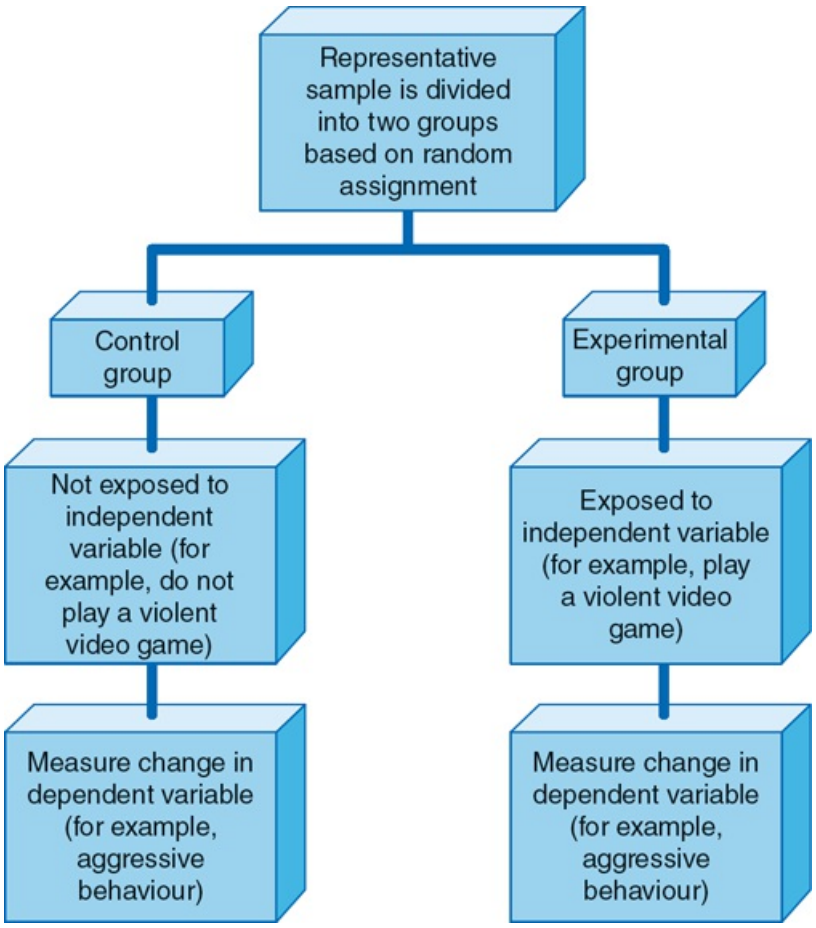


FIGURE 2.4 The experimental design Key features of experimental designs are independent and dependent variables and random assignment of experimental and control groups.

In addition, experimenters must be careful when deciding what tasks will be performed by participants in the control group. Researchers often have the participants in a control group engage in an activity of some kind, just to make sure that the changes seen in the experimental participants are indeed due to the impact of the independent variable and not the result of the experimental participants being particularly active during the study (see photo). You might, for example, have your control group participants play another game that is engaging but less violent, such as a soccer video game. If afterwards the experimental participants still demonstrate more aggressive behaviour than the control participants, you can be more certain that the violent video game is in fact responsible.

Picture Partners/Alamy Stock Photo

Experimental answer **Do complex visual images stimulate babies? To answer this causal question, experimenters showed swirling designs to one group of babies (experimental group) and bland designs to another group (control group). Babies in the experimental group typically attended to their designs longer than did those in the control group, suggesting that complex images do indeed attract the attention of babies.**

Finally, experimenters must be careful to avoid bias in their studies. Once again, they must avoid subject bias and researcher bias—sources of bias that we discussed earlier. In addition, they must set up their studies so that they do not unintentionally convey to participants the outcome that they (the experimenters) expect to see, an undesired effect known as a *demand characteristic*. If a researcher were to tell participants in the experimental group of the video gaming study that their answers to an assertiveness and aggressiveness questionnaire will indicate how much violent video games contribute to problematic real-life behaviour, the researcher might be creating ademand characteristic that encourages those participants playing violent video games to understate their aggressive inclinations while those not playing violent games might overstate their friendliness or co-operativeness. For this reason, while it is sometimes hard to do, many studies, particularly pharmaceutical ones, are designed so that the persons who administer the study or who evaluate the behaviour of participants are unaware of the hypotheses of the study (Remler & Van Ryzin, 2015). Indeed, many studies use a specialized method known as a **double-blind procedure**, in which neither the participant nor the researcher knows which group—experimental or control—the participant is in. In drug studies, some participants get real medication while others get pills designed to look like the real medication but which actually do not contain any of the active drugs being assessed (known as a placebo). This information about who gets which drug is sealed and only revealed after the data for the study have been collected (Wender et al., 2011). Double-blind studies help keep researchers from observing or creating what they want to observe and participants from intentionally acting in ways that confirm a researcher's hypothesis. We will now go on to talk about how psychologists make sense out of their results. One way

they can do that is to look to see how they apply to parts of the real world. Industrial/organizational psychologists, for example, apply their research to important questions in workplaces such as how organizations can hire the right people and place them in the right job situations. You can see how they do this in the Psychology@Work video on Job Analysis: Research and Statistics.

double-blind procedure study in which neither the participant nor the researcher knows what treatment or procedure the participant is receiving.

Video **PSYCHOLOGY@WORK**

Job Analysis: Research and Statistics **This video looks at the I/O research and theory area involved in helping companies fully and properly describe jobs and at some of the methodological challenges involved in doing this sort of work well and ethically.**

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

7. Which variable is controlled or manipulated by an experimenter?

8. What are three descriptive research methods used in psychology?

9. Which research method allows researchers to say that one variable causes another?

What Do You Think? • What would you conclude if people's aggressive behaviour increased after an hour of violent video game playing? How would that conclusion be different if aggressive behaviour only increased after a marathon of violent video game playing?

How Do Psychologists Make Sense of Research Results?

LEARNING OBJECTIVE 4

Describe what information is conveyed by statistics, including correlation coefficients, means, and standard deviations, and explain how psychologists draw conclusions about cause and effect.

Once researchers obtain results from an experiment or descriptive study, what do they do with them? Can they simply eyeball their findings and say that there's a relationship between this and that variable, or that the two groups under study are different? No, scientists cannot depend just on impressions or logic. If they tried, they would have no way of knowing whether a relationship found between variables or a difference between groups

actually matters (see Indigenous Experiences 2.1).

2.1 Indigenous Experiences

Indigenous Ways of Understanding

Heather Schmidt, at Cape Breton University, is a community psychologist who engages in research using a collaborative decolonizing approach. Schmidt advocates for inclusion and social justice for marginalized communities and for using research methodologies that recognize and respect Indigenous ways of understanding. She argues that it is imperative that non-Indigenous scholars find ways to identify and behave as cultural allies. Schmidt also promotes the importance of integrating Indigenous knowledge into post-secondary teaching, arguing that most existing courses in the post-secondary system "have long been limited to a Eurocentric perspective" (Schmidt, 2019, p. 71), which must change. Schmidt points out that the Canadian Psychological Association (CPA) responded in 2018 to the Truth and Reconciliation Commission's 94 calls to action (2015) by recommending that all undergraduate psychology students have access to one or more courses that teach Indigenous worldviews, discuss the impact of colonization on Indigenous peoples in Canada, and address more inclusive approaches to Indigenous psychology.

The CPA response to the Truth and Reconciliation Commission task force recommendations also emphasized the importance of collaborating with many diverse Indigenous cultures, rather than mistaking all Indigenous cultures as equivalent, thereby acknowledging the multiplicity of Indigenous cultures, languages, traditions, worldviews, and structures, each with distinct economies, skills, and challenges. The CPA response also addressed the need for the greater utilization of *participatory research methods* in order to better develop "culturally grounded assessments and approaches" (Canadian Psychological Association & the Psychology Foundation of Canada, 2018, p. 16). Participatory research methods merge education and political action with scientific approaches when seeking to address a specific research question. The participatory approach is therefore less quantified, abstract, and hierarchical than the more traditional forms of research that are typically employed in Western cultures. These more traditional Western approaches rely largely on objective, reductionist, mechanistic models of human behaviour in diagnostic contexts. Conversely, researchers using participatory approaches work collaboratively with community members toward an understanding and resolution of community problems by directly engaging members of the community in the research. For example, a participatory approach to a construct such as "intelligence" would take into account the "concrete lived experience" of the individual as well as the context of the community within the larger sociopolitical context. A participatory approach to assessing intelligence would also create optimal testing situations by building in community support. Participatory approaches are also ethically and philosophically compatible with Indigenous peoples' spiritual experiences and cultural knowledge through recognition of the importance of vision quests, sweat lodges, and the medicine wheel. For example, formal diagnoses are not reassuring to many Indigenous people because they view diagnostic labels as "bad medicine," believing that stigmatizing labels may serve to remove positive spirit

from a person.

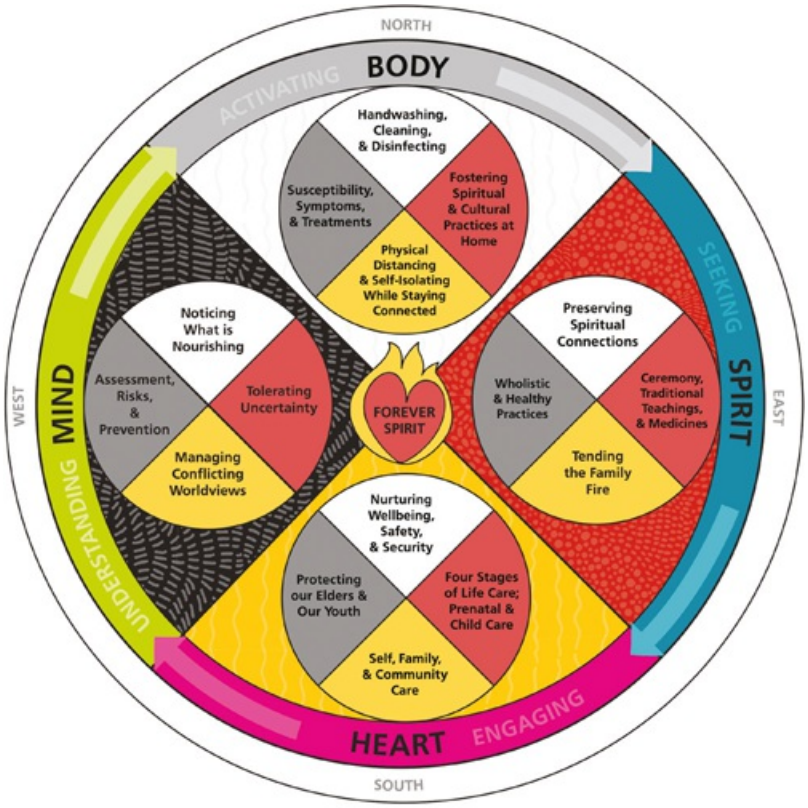
In an effort to ensure a more fluid approach to indigenizing academic content, Mi'kmaw elders Albert Marshall and Murdena Marshall created a concept known as "two-eyed seeing." Two-eyed seeing uses one eye to view the strengths of Western ways of knowing and the other eye to view the strengths of Indigenous ways of knowing. Using both eyes together then becomes a way of reconciling the two approaches (Bartlett, Marshall, & Marshall, 2012; Marsh et al., 2015). However, Schmidt (2019) states that, "Even when all parties are working diligently and with good hearts, [two-eyed seeing] still involves a difficult commitment to lifelong learning and immense patience" (p. 66). Nonetheless, as post-secondary institutions across Canada move to indigenize curricula, decolonizing both teaching and research is imperative.

Critical Thinking Questions

What sorts of things should researchers do in order to *collaborate with* rather than simply study diverse Indigenous cultures?

How does a participatory approach to research differ from traditional approaches to psychological research? Why are these differences important?

What is the Mi'kmaw concept of "two-eyed seeing" and what implications would using it have for research involving Indigenous people.



Source: Women Indigenous Health

Medicine wheel **The medicine wheel (also called the sacred hoop or sacred circle) has been used by Indigenous peoples for generations. The medicine wheel is a symbolic depiction for balancing four aspects of being: the spiritual, emotional, physical, and mental. If a person is out of balance, they experience disease.**

Psychologists use *statistics* to describe and measure relationships between variables. Scientists use many statistical analyses to look at the differences and similarities between groups (Coolican, 2017; Goodwin, 2011). We won't go into a lot of depth about statistics here (for more details see Appendix B). We will, however, give you a few tips to help you understand the research findings you'll be reading about in this book and elsewhere. We will discuss correlations, which describe the relationships between variables, and then go on to discuss the statistical tests researchers use to determine how likely it is that their results are occurring simply by chance. Then, we will examine how researchers use the statistical results to decide whether or not their hypothesis has been supported and to guide the next steps in the research process.

Correlations: Measures of Relationships

A predictable relationship between two or more variables is called a **correlation** (for more detailed information on correlation, see Appendix B). To describe correlations, especially in descriptive studies, psychologists use a statistic called a **correlation coefficient**.

correlation predictable relationship between two or more variables.

correlation coefficient statistic expressing the strength and nature of a relationship between two variables.

A correlation coefficient can range from −1.00 to +1.00. The number itself and the positive or negative sign in the correlation coefficient each convey different information.

The positive or negative sign tells you the direction of the relationship. When scores on both variables get bigger together, the relationship is known as a **positive correlation**. In our example, we predicted a positive correlation between violent video gaming and aggressive behaviour: as playing increases, so will aggressive behaviour. If we had suggested that aggressive behaviour does not increase, but actually drops, as people game more and more (perhaps because violent gaming could serve to release and thus reduce aggressive urges), then we would be predicting a **negative correlation**. When the variables are negatively correlated, higher scores on one variable are related to lower scores on another variable. **Figure 2.5** shows various types of relationships.

positive correlation relationship in which, on average, scores on two variables increase together.

negative correlation relationship in which, on average, scores on one variable increase as scores on another variable decrease.

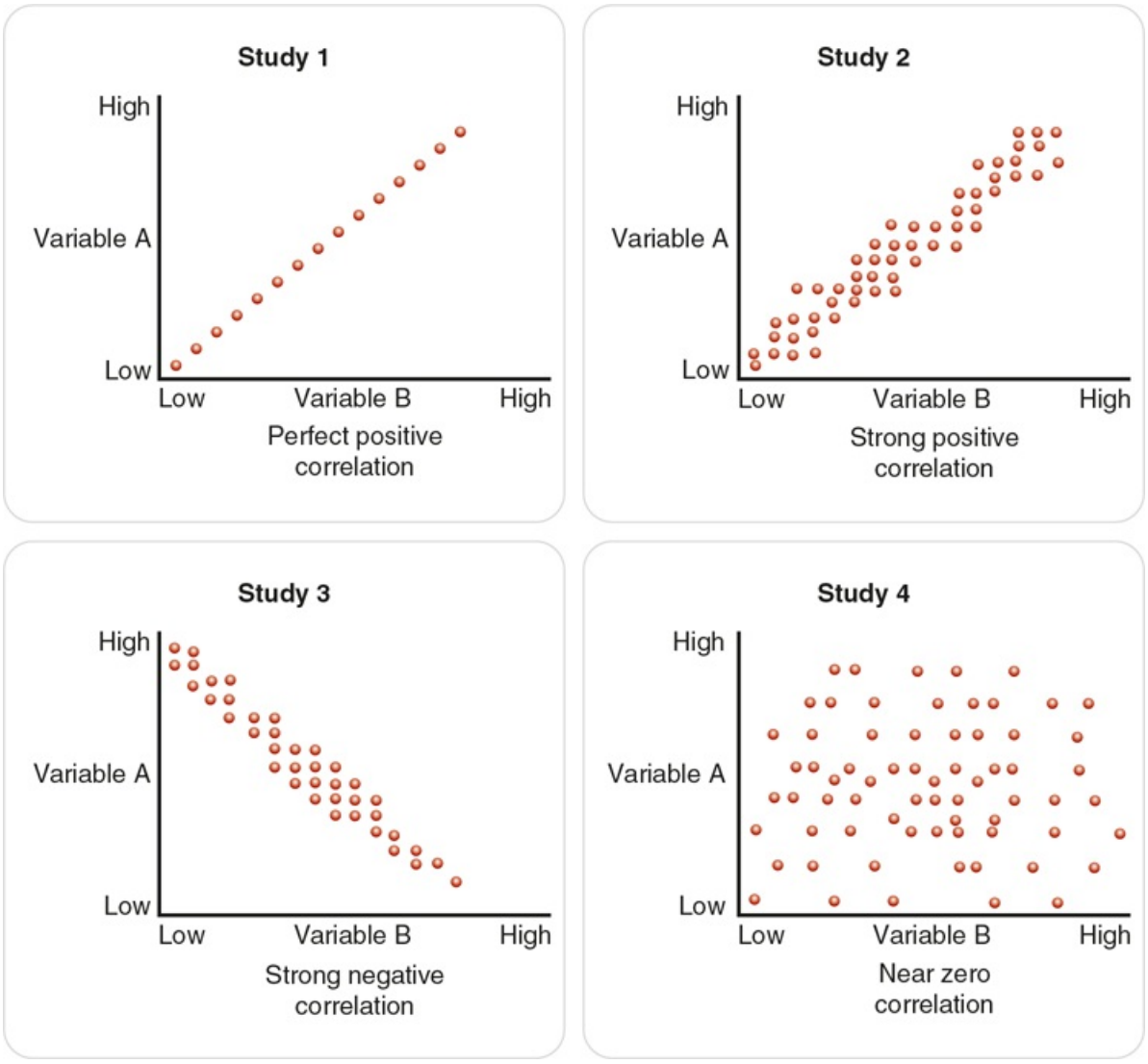


FIGURE 2.5 Graphing correlations **If we were to plot each participant's score on Variable A and Variable B on a graph, we would see that the variables display a perfect positive correlation in Study 1, strong positive correlation in Study 2, strong negative correlation in Study 3, and near zero correlation in Study 4.**

In addition to looking at the positive or negative sign, we must consider the value of the number in the correlation coefficient. The number tells the size, or strength, of the relationship between variables—that is, how well we can predict one variable if we know the other. The larger the number, the stronger the relationship and the tighter packed the data cloud in the graph appears to be. Thus, a correlation coefficient of 0 means that there is no linear relationship between the two variables and if you look at the graph of the zero correlation data you can easily see that there appears to be no clear relationship at all between the graphed variables. Knowing a person's score on one variable tells you nothing about the person's score on the other. The farther a correlation coefficient gets from 0 in either the positive or negative direction, the stronger the relationship between the two variables. A high positive correlation coefficient means that scores on the two variables under examination typically rise and fall together (and produce a rather tight data cloud

when graphed), and a high negative correlation coefficient means that a rise in one of the variables usually is accompanied by a fall in the other. A correlation of −1.00 or +1.00 is known as a **perfect correlation**, one in which the variables' scores are always perfectly related. One score always rises or falls in direct proportion to the changes in the other variable. We do not see this sort of relationship very often in psychology as things are often much more complicated in our studies.

> **perfect correlation** one in which two variables are exactly related, such that low, medium, and high scores on both variables are always exactly related.

Again, it is important to keep in mind that in correlation coefficients, the positive and negative sign and the number itself provide two different pieces of information. A correlation with a negative coefficient is not weaker than one with a positive coefficient. In fact, the relationship may be stronger if, for example, the negative correlation is −0.7 and the positive correlation is +0.2. A negative correlation of −0.7 would mean that the two variables are quite strongly related in such a way that low scores on one variable very often are associated with high scores on the other (see **Figure 2.6**).

FIGURE 2.6 How to read a correlation coefficient The sign of the coefficient tells us the direction and the number tells us the magnitude, or strength, of the relationship between two variables.

In psychology, really exciting relationships are often reflected by a correlation coefficient of 0.3 and above. This is far from a perfect correlation, largely because relationships between behaviours, thoughts, and emotions can be so complex and because so many other variables may also be at work in such relationships. Nevertheless, 0.3 or above typically means that the two variables in question do indeed have some kind of predictable relationship.

Correlations offer lots of useful information, particularly when we are interested in the scientific goal of prediction (Girden & Kabacoff, 2011). The correlation coefficient tells us just how well we can use one piece of information about someone, such as how much the person plays violent video games, to predict her behaviour in another realm, in this case aggressive behaviour. One key piece of information correlations do *not* tell us, however, is *causality* (Remler & Van Ryzin, 2015). That is, they do not shed light on whether or not a change in one variable actually causes the change in the other (see **Figure 2.7**). We will get positive correlations if violent gaming causes aggressive behaviour, but we will also get positive correlations if aggressive people prefer to play violent video games. So we must be careful when talking about the causal implication of correlational research. As we mentioned earlier, only experimental studies and experimental analyses can tell us whether causality is at work.

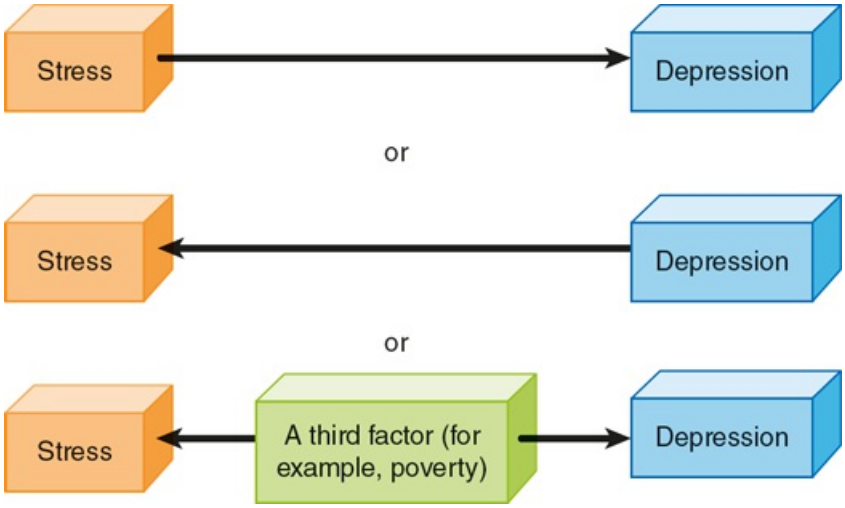


FIGURE 2.7 Correlation versus causation **Research has found a strong correlation between stress and clinical depression. However, this correlation does not tell us whether stress causes depression, depression causes stressful events, or other factors, such as poverty, produce both stress and depression.**

You may have already made the connection, but the descriptive approach to psychological research described earlier in this chapter is also called correlational research, as it often involves looking at the relationships among variables using correlation statistics. Researchers using these approaches to their data are appropriately cautious about drawing conclusions about causality when using correlations (see photos). However, they also know that over a number of studies, correlations can help us narrow down the causal factors that could be at work in the situations we are studying. For example, Andrew Harrell at the University of Alberta (Harrell, 1981) found that general tolerance for violence was more strongly positively correlated with verbal hostility while watching hockey (a somewhat violent sport) than was frequency of exposure to hockey. This suggests that just watching hockey or lots of hockey may not be a significant causal factor in increasing aggressiveness, unless the people involved are already tolerant of violence. So correlational research can and does help us narrow down the causal possibilities in the behaviour we are studying.

stefanoborsani/Getty Images

slobo/Getty Images

Correlation versus causality **The repeated co-occurrence of two events (correlation) does not necessarily mean that one is causing the other. Children who eat ice cream, for example, tend to have bike accidents. It may be that eating ice cream while riding causes young bikers to have more accidents. Or, it may be that parents typically treat their children to ice cream whenever they have accidents. Or, perhaps hot summer days lead to increases in both ice cream eating and bike riding.**

Experimental Analyses: Establishing Cause and Effect

If you want to examine differences between groups and determine the cause of such differences, you have to do a particular kind of statistical analyses. Collectively, these are called *experimental analyses* because they are associated with experiments. Researchers sometimes divide experimental analyses into two categories: *descriptive statistics*, which describe or summarize the data gathered from a study, and *inferential statistics*, which tell researchers what they can conclude, or infer, more broadly from their results (for more information, see Appendix B).

In order to describe differences between the scores of experimental groups and control groups, researchers calculate the *mean* and *standard deviation* of each group. The **mean** is the arithmetic average of the scores of all participants in a group. This is the same average you've been calculating since Grade 4 math class. Big differences between the mean—the average score—of an experimental group and the mean of a control group may indeed suggest big differences between the participants in the groups.

mean arithmetic average of a set of scores.

To be certain of this, however, researchers also look at the **standard deviation**, an index of how much the participants' scores *vary* from one another within each group. (Basically it is the square root of the average of the squared differences between each score and the group average . . . think about it, it makes sense.) Suppose, for example, you have 10 control-group participants who play a video soccer game and then obtain scores of 4, 5, 4, 6, 5, 4, 4, 7, 5, and 6 on an aggressiveness scale, and 10 experimental-group participants who play a first person shooter combat video game, then obtain scores of 1, 2, 12, 11, 5, 9, 4, 1, 3, and 2.

Each group would have a mean score of 5 aggressiveness points. Unless you also examine the standard deviations for both groups (1.05 for the control group and 4.20 for the experimental group), you might not realize that there are more extreme reactions in the first person shooter game group than in the other group (see **Figure 2.8A** and **Figure 2.8B**).

standard deviation statistical index of how much scores vary within a group.

FIGURE 2.8A Variability and the standard deviation Although these two sets of data have the same mean, or average, score of aggressiveness in our fictitious study, players of a first person shooter game are much more varied in their aggressiveness scores (high standard deviation) than are players of soccer (low standard deviation).

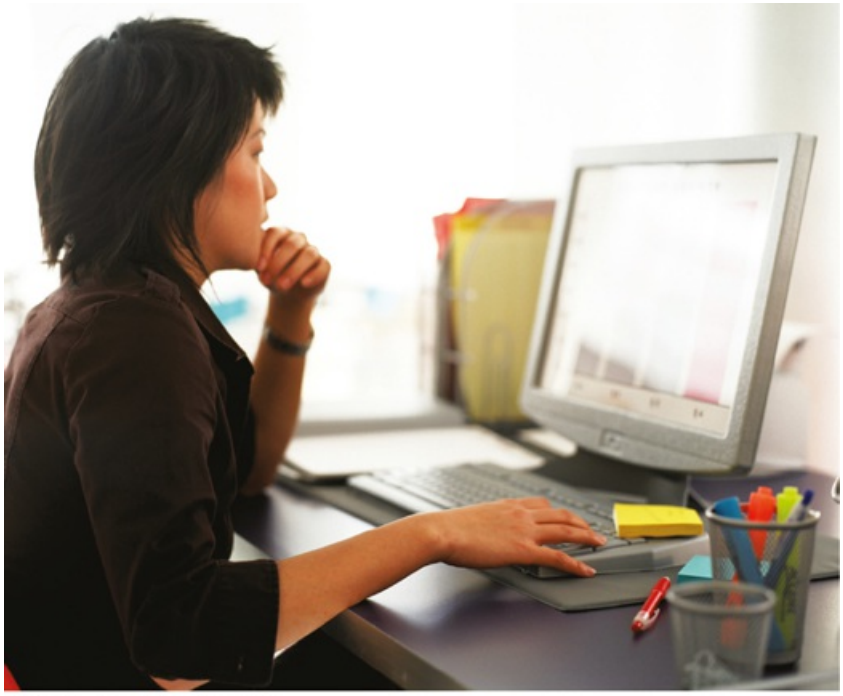
	Soccer	Violent First Person Shooter Game	Soccer	Less Violent (Questing) First Person Shooter Game
	4	5	2	3
	5	7	5	6
	4	9	4	9
	6	9	6	9
	5	7	5	7
	4	9	4	9
	4	5	1	4
	7	7	10	7
	5	5	5	6
	6	8	8	10
Means	**5**	**7**	**5**	**7**
Standard deviations	**1.1**	**1.7**	**2.6**	**2.3**
		Significant		**Not Significant**

FIGURE 2.8B Statistical significance In these two studies, the aggressiveness differences between soccer game players and the violent first person shooter game players is real or statistically significant because the means are different and variability in each group is low while the same differences between the soccer group and a less violent (questing) first person shooter game group are not significant because there are higher standard deviations or greater variability in those two groups.

After determining the mean and standard deviation of each group, researchers can compare the two groups. Psychologists typically compare means using statistical procedures known as *t-tests* (for two groups) or *analyses of variance* (for two or more groups). These procedures look both at the mean differences and at the variance within the groups, as well as at the size of the groups, and essentially ask whether the two groups in the sample being studied are different given their average scores and the variability of their scores as reflected by their standard deviations. The statistical procedures are known as significance tests because they measure whether the differences found between groups are *statistically significant*, or whether they are likely to be genuine and non-random, or chance occurrences.

In statistics, the word *significant* has a slightly different meaning from most people's everyday use of the same word. A test of statistical significance tells us how likely it is that the differences found between groups (drawn from a larger population) are due to experimental manipulations rather than due to chance. Such tests indicate this likelihood

by calculating a *probability statistic*. If a test of statistical significance yields a probability statistic of ρ = .05, it means that if researchers were to conduct the same study 100 times, they would, by chance alone, get the same result found in the current study less than 5 percent of the time, if there really were no difference between the populations from which the samples were obtained. In other words, there's an extremely low probability that the result found in the current study occurred simply as a random act of chance. Most likely, it occurred because of a real difference between the two groups of subjects in the study. By convention, when a test of statistical analysis yields a probability of less than .05(ρ < .05), psychological researchers conclude that the difference they have found between groups in their study is statistically significant—there is likely to be a real difference that is due to the manipulations carried out in the study (see photo).



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Analyzing the results **A big part of conducting good research is knowing how to properly handle the numbers gathered and the findings they represent.**

Keep in mind that the numerical difference between group means and the probability statistic says nothing about the size of the effect you're seeing in your study. Let's say that participants who play a first person shooter game later display a higher mean aggressiveness score than do those who play soccer, and that the probability statistic is less than 0.01(ρ < .01). This does not necessarily mean that the first person shooter gamers have become *much* more aggressive than the soccer players. It just means that there's less than 1 chance in 100 that you obtained that result by chance. If you want to know how big the effect of violent gaming is, you need to calculate yet another statistic, known as *effect size*, which describes the strength of the relationship between two variables. If you were to find a large effect size in your study, it would suggest that violent gaming strongly increases aggressive behaviour (for more information, see Appendix B).

Using Statistics to Evaluate and Plan Research

If you get a result like this—a difference between groups that is very unlikely to have occurred by chance—does it mean you have fully supported your hypothesis and should sit back and toast your success? Well, not yet. Scientists need to be sure. They need to go back and test their hypotheses some more. It is only through **replication**, taking the data from one observation and expanding on it to see if it holds up under multiple conditions and in multiple samples, that we can determine whether what we hypothesize is correct. Over time, replication enables hypotheses to become theories and theories to become laws.

> **replication** repeated testing of a hypothesis to ensure that the results you achieve in one experiment are not due to chance.

Another important part of science is to use different research methods to explore the same research question (Coolican, 2017; McGrath, 2011). If researchers use several approaches, including surveys, experimentation, and independent observations, and obtain similar results, they can be more certain that their hypotheses are accurate and have confidence about incorporating those hypotheses into theories. Researchers generally share their findings through scientific journal articles (see Practically Speaking 2.1).

2.1 Practically Speaking

Tips on Reading a Scientific Journal Article

As a psychology student, particularly if you major in psychology, you will most likely read journal articles for some of your required classes. Initially, this task may seem overwhelming. The authors of journal articles tend to use unfamiliar language, condense complex concepts into a small space, and make assumptions about the reader's knowledge of their topic. However, you can turn this task into something interesting and worthwhile by following a few simple steps.

When you read a research paper, try to understand the scientific contributions the authors are making. You should read the paper critically and not assume that the authors are always correct.

You do not need to read the paper sequentially to get the gist of it. First, you might read the abstract, the introduction, the start of the discussion, and the conclusions. Next, look through the references to determine whose work is at the root of the current research. After this first read-through, try to summarize the article in one or two sentences.

Then, go back and read the entire paper from beginning to end. Study the figures, re-read parts that are difficult to understand, and look up unfamiliar words. Make notes in the margins or on separate sheets of paper. And answer the following questions as you work:

Title: What does this tell you about the problem?

Abstract: What does this general overview tell you about the current paper?

Introduction: What are the authors' assumptions, important ideas, and hypotheses?

Methods: Do the methods seem to effectively test the authors' hypotheses?

Related work: How does the current work relate to past work? What is new or different about the current study?

Conclusions: What were the study's results, and do they make sense? Did what the researchers have to say about their results make sense to you? What were the study's limitations? What do the authors propose for future research? How does the study contribute to a better understanding of the problem?

You also may choose to outline, summarize, or keep more detailed notes, especially if you are using the article for a term paper.

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As we described earlier in our discussion of the scientific method, a theory is also a framework to generate additional hypotheses. If your hypothesis about violent video gaming proves correct, and people on average report themselves to be more aggressive and exhibit more aggressive behaviours on experimental tasks after playing a first person shooter game, you have reason to continue your line of research. You can conduct the same experiment with other games, and see whether the hypothesis continues to hold up for all kinds of aggressive or violent games. You may also decide to look at other forms of social behaviour besides aggressiveness, such as empathy or sense of fair play. If you continue to replicate these results with other games and other social behaviours, you are effectively supporting the theory that violent gaming in fact contributes to increased aggressive behaviour within Canadian culture. A Nobel Prize (or perhaps the Order of Canada) is inevitable.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

10. What two pieces of information does a correlation coefficient give about the relationship between variables?

11. What do the mean and standard deviation tell you about scores of a group?

12. What do *t*-tests tell experimenters?

What Do You Think? • What are some examples of positive and negative correlations that you have observed in everyday life?

What Ethical Research Guidelines Do Psychologists Follow?

LEARNING OBJECTIVE 5

Describe what ethical steps psychologists take to protect the rights of human research participants.

Video **PSYCHOLOGY@WORK**

The Ethics of Taking Psychology to Work **This video examines the ways in which I/O psychologists engage with the ethics of their field and practice. In addition to research ethics, like all psychologists, I/O psychologists also engage in applied work with organizations and companies in ways that impact the lives of current and future employees. This work adds an additional layer of ethical concern and practice to I/O psychology.**

Today, psychological research must be designed with the goal of protecting the participants (human or animal) involved with the study. Psychology researchers are bound by the same broad ethical principles that govern doctors and other clinicians. The Code of Ethics of the Canadian Psychological Association (CPA) states it clearly: "psychologists have a higher duty of care to members of society than the general duty of care that all members of society have to each other" (CPA, 2017). In much of the research conducted by psychologists, the participants are individual persons and as such the ethical guidelines discussed below are aimed at how psychologists engage with their individual research participants. Industrial/organizational psychologists must also adhere to these ethical guidelines but their research and consulting often involves working with organizations in addition to individuals and as such they must also consider their ethical responsibilities for how the organizations they work with use the results of their research or consulting work. (See the Psychology@Work video on the Ethics of Taking Psychology to Work.)

Research ethics in Canada are guided by a joint statement on the ethics of research involving human participants created by the three main research grant agencies: the

Canadian Institutes of Health Research (CIHR), the Natural Science and Engineering Research Council of Canada (NSERC), and the Social Sciences and Humanities Research Council of Canada (SSHRC). To ensure that researchers follow proper ethical practices, **research ethics boards (REBs)** provide oversight in academic and other research settings across the world. Any institution (university, private corporation, government agency, or medical school) conducting research involving human participants is expected to appoint an REB, which consists of a mixture of researchers from inside and outside the field. REBs examine research proposals and rule on the potential risks and benefits of each study's procedures (CIHR, NSERC, SSHRC, 2010). If the risk or discomfort associated with a proposed study is deemed to outweigh the potential scientific benefit from the study, then the undertaking is rejected. REBs generally require that psychologists studying human participants take the following steps to protect human participants:

Obtain informed consent. **Informed consent** from participants requires that researchers give as much information as possible about the purpose, procedures, risks, and benefits of a study, so participants can make informed decisions about whether they want to be involved in the study (Nagy, 2011). If participants include children, researchers must obtain informed consent from both the parents or caregivers and the child (see photo).

Protect participants from harm and discomfort. In addition to medical or physical risks, such as those faced by the patients in psychiatrist Donald Cameron's experiments (see Psychology Around Us 2.2), researchers must avoid putting participants in situations that could cause them undue emotional stress, for example.

Protect confidentiality. Researchers must have in place, and explain to participants, careful plans to protect information about the identities of participants and the confidentiality of their research responses.

Make participation voluntary. Researchers must make it clear that participants have the right to decide not to participate in the study and that their decision will in no way affect their treatment or involvement in a related class or any other activity. Further, participants have the right to end their participation at any point or to decline to answer any particular questions during the study.

Do not use deception or incomplete disclosure. Researchers must be completely open about the methods and purpose of their research so that participant consent is fully informed. Deception, such as providing participants with false feedback on a test to manipulate their moods, is rarely permitted, and then only when no alternative methods are available. Steps must be clearly taken to ensure the long-term effects of such deception are negligible. In addition, supports must be immediately available for negatively affected participants.

Provide complete debriefing. In some cases, if participants were to have full knowledge about the purposes and goals of a study before it began, their responses during the study might be influenced by that knowledge. Researchers often try to balance giving participants enough information before a study to protect their rights, yet withholding information that may affect participants' responses. Thus, at the end of a study, researchers are required to offer a **debriefing** to participants—an information session during which they reveal any information that was withheld earlier.

research ethics board (REB) research oversight group that evaluates research to protect the rights of participants in the study.

informed consent what occurs when researchers give as much information as possible about the purpose, procedures, risks, and benefits of the study so that a participant can make an informed decision about whether or not to participate.

debriefing the supplying of full information to participants at the end of their participation in a research study.

2.2 Psychology Around Us

A Notorious Project

Between 1957 and 1964, a psychiatrist named Donald Cameron employed at Allen Memorial Institute at McGill University worked under a contract with the American Central Intelligence Agency (CIA) as part of a larger project called MKULTRA (Collins, 2002; Gold, 2019; Klein, 2007). As part of that project, Cameron administered LSD (a drug that influences brain neurochemistry and produces hallucinations) and electroconvulsive therapy (ECT, a shock delivered to the brain that induces epileptic seizures) to patients who had entered the institute with relatively minor mental health issues, such as postpartum depression or anxiety disorders.

Linda Macdonald was one of those participants. In 1963 she checked into a Canadian institution to be treated for fatigue and depression. Six months later, she couldn't read, write, cook a meal, or make a bed. She did not remember her husband, her five children, or any of the first 26 years of her life. During her stay, Ms. Macdonald was given massive doses of various drugs, put into a drug-induced sleep for 86 days, given more than 100 electroconvulsive treatments, and exposed to "psychic driving," a technique in which repetitive taped messages were played for her 16 hours a day. The purpose was not to treat this woman's depression, but to gather information about the causes and effects of brainwashing (Davis, 1992; Powis, 1990).

During this project, the drug and ECT were administered without the patients' consent and were not primarily intended to treat their conditions. Instead, they were used to examine the drug's and ECT's potential effectiveness as interrogation or mind control techniques. The patients sustained permanent damage as a result of their treatments, including loss of identity or loss of speech, and loss of memory. When this work was made public by the TV show *the fifth estate* in 1985, it was discovered that the Canadian government was aware of the research. The patients were unable to sue the CIA for their treatment, but they did eventually receive a $100,000 payment from the Canadian government (Gold, 2019).

These sorts of horror stories illustrate the potential for serious harm in some psychological studies. Participants need to be clearly informed about just what they are getting into, and that they have the right to refuse or discontinue involvement in research at any point. It also shows the need for a set of strict guidelines regarding the ethical treatment of research participants and the ethical design and conduct of

psychological experiments.

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Consent has its limits To protect children who participate in studies, researchers must also obtain informed consent from their parents or caregivers.

In addition to ruling on the costs and benefits of the study, research ethics boards also assess other issues. They look, for example, at the compensation individuals receive for their participation (to make sure that participants are not tempted to participate in potentially dangerous studies by high levels of compensation), and they determine whether particular groups (such as men, women, or members of minority ethnic groups) are singled out unnecessarily.

As a result of these ethical guidelines, several of the older "classic" psychological studies we will discuss later in this book would not be approved by a university REB today. See if you can identify which studies these are, and why, when we discuss them.

The ethical research guidelines we have discussed so far cover research with human beings. However, as you may already know, a lot of research in psychology involves the use of animals as participants. Animal rights advocates point out that animals are especially vulnerable research participants since they cannot give their consent to be part of a study. They also argue that animals may be exposed to more extreme risks than humans, for sometimes unclear benefits.

Psychologists take their ethical obligations toward animal research participants very seriously. The Canadian Council on Animal Care (CCAC, 2016) has crafted a set of ethical guidelines for research involving animals and works to ensure that the guidelines are followed. Its code includes the following points:

> "The use of animals in research, teaching, and testing is acceptable ONLY if it promises to contribute to understanding of fundamental biological principles, or to the development of knowledge that can reasonably be expected to benefit humans or animals."

Animals should be used only if the researcher's best efforts to find an alternative have failed.

Those using animals should employ the most humane methods on the smallest number of appropriate animals required to obtain valid information.

Other parts of the code seek to limit pain or distress, ensure proper recovery periods, and ensure general humane treatment of animal participants.

All such guidelines—for both animal and human research undertakings—help ensure not only more ethical procedures, but better science as well.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

13. What does a research ethics board do?

14. What is informed consent and how does it relate to debriefing?

What Do You Think? • Are ethical standards different for psychology than those for other sciences? Should they be?

Summary

What Is a Science?

LEARNING OBJECTIVE 1 List two core beliefs of science, and describe the steps in the scientific method.

Science is an approach to knowing the world built on the core principles that: (1) the universe operates according to certain natural laws, and (2) these laws are discoverable and testable.

Science is founded upon the scientific method, a process that moves from making controlled, direct observations to generating progressively broader conclusions and tests and attempting to disprove hypotheses.

Is Psychology a Science?

LEARNING OBJECTIVE 2 Compare and contrast psychology with other natural sciences, such as biology, chemistry, and physics, and with pseudosciences, such as astrology.

Psychology shares with every science the primary goals of describing, explaining, predicting, and controlling the objects of study. The goals of psychology differ from those of other sciences because the search for elements of mental processes and behaviour is complicated by constantly shifting human factors.

Psychology also shares more similarity with the fields of religion and philosophy than

many sciences do because psychological findings are more often associated with values, morality, and personal preference.

Psychology is different from pseudopsychology. Although the latter also attempts to answer fundamental questions about human nature and behaviour, it has no basis in the scientific method.

How Do Psychologists Conduct Research?

LEARNING OBJECTIVE 3 List steps in the research process and key characteristics of descriptive and experimental psychological research methods.

Psychological research is rooted in first generating a hypothesis, or prediction, about the relationship between two or more variables based on observations.

Psychologists conduct research with a sample, a small group meant to represent the larger population of interest. The best means of selecting a sample is random selection, a procedure in which everyone in the population has an equal chance of being selected to be in the sample.

Descriptive research methods include case studies, naturalistic observations, and surveys.

Case studies are in-depth observations of a single individual.

Naturalistic observation involves observing people in settings outside of laboratories where their behaviour occurs naturally.

Surveys may be conducted in interviews or with questionnaires.

Only experiments allow researchers to draw conclusions about cause-and-effect relationships.

All research methods have advantages for particular uses and all are subject to various drawbacks. Researchers must plan carefully to avoid subject bias, researcher bias, and demand characteristics.

How Do Psychologists Make Sense of Research Results?

LEARNING OBJECTIVE 4 Describe what information is conveyed by statistics, including correlation coefficients, means, and standard deviations, and explain how psychologists draw conclusions about cause and effect.

Correlations allow us to describe and measure relationships between two or more variables. A correlation coefficient tells the direction and size of a correlation.

Researchers use the mean and standard deviation to describe and summarize their results.

Researchers use probability statistics to determine the statistical significance of results. Effect size tells how strong the relationship is between variables.

Replication of experiments and repeated study of the same predictions using different methods help hypotheses become theories.

What Ethical Research Guidelines Do Psychologists Follow?

LEARNING OBJECTIVE 5 Describe what ethical steps psychologists take to protect the rights of human research participants.

Today, oversight boards called research ethics boards (REBs) help to protect human rights.

Psychological researchers must obtain informed consent from human participants, protect them from harm and discomfort, protect their confidentiality, and completely debrief them at the end of their participation.

The use of animal participants in research has also raised ethical concerns. An oversight council called the Canadian Council on Animal Care (CCAC) works to protect animals' needs and comfort in experiments.

Key Terms

biases

case study

control group

correlation

correlation coefficient

debriefing

deductive reasoning

dependent variable

descriptive research methods

double-blind procedure

empirical

experiment

experimental group

Hawthorne effect

hypothesis

hypothetico-deductive reasoning

independent variable

inductive reasoning

informed consent

mean

naturalistic observation

negative correlation

operationalize

perfect correlation

positive correlation

random assignment

random selection

replication

research ethics board (REB)

sample

standard deviation

survey

theories

variable

Self-Study Questions

Multiple Choice

1. A given field of study is defined as a science by virtue of its

- **a.** scientific methods.
- **b.** equipment.
- **c.** subject matter.
- **d.** findings.

2. Most psychologists today use a type of reasoning termed _____ reasoning.

- **a.** theoretico-inductive
- **b.** theoretico-deductive
- **c.** hypothetico-inductive
- **d.** hypothetico-deductive

3. Which approach to psychology advocated focus on observable behaviours only?

- **a.** hypothetico-deductive
- **b.** inductive reasoning
- **c.** pseudopsychology
- **d.** behaviourism

4. Which of the following is an example of pseudopsychology?

a. astronomy

b. astrology

c. Gestalt

d. Maharishi

5. A researcher observed the eating patterns of laboratory rats while manipulating the amount of sleep they received during a week-long study. In this example, what type of variable is "sleep"?

a. observable

b. dependent

c. independent

d. extraneous

6. Which of the following is not a descriptive research method?

a. case study

b. experiment

c. naturalistic observation

d. survey

7. What method do psychologists use to analyze study data?

a. logic

b. induction

c. statistics

d. deduction

8. Which of the following statistical procedures can be used to determine to what degree participants' scores within a group vary?

a. standard deviation

b. mean

c. *t*-test

d. analysis of variance

9. Researchers may use deception in their study designs

a. only when no alternative method is available.

b. only if they inform their participants before they begin the study.

c. under no circumstances.

d. only if they obtain permission from their college or university counselling centre.

10. Which of the following sequences best reflects the order of events in a typical experimental session?

a. informed consent → debriefing → experiment

b. informed consent → experiment → debriefing

c. debriefing → informed consent → experiment

d. debriefing → experiment → informed consent

Fill-in-the-Blank

1. The natural law of _____ suggests that when something is set in motion, it has an effect on other things.

2. Ideas that psychologists develop about the laws that govern processes and behaviour are called _____.

3. The field of _____ is often credited with shifting psychology from a philosophy to a science.

4. Forced sterilization and controlled breeding are two consequences of _____.

5. A subset of a population is known as a(n) _____.

6. The research methodology that asks participants to answer a series of questions is called a(n) _____.

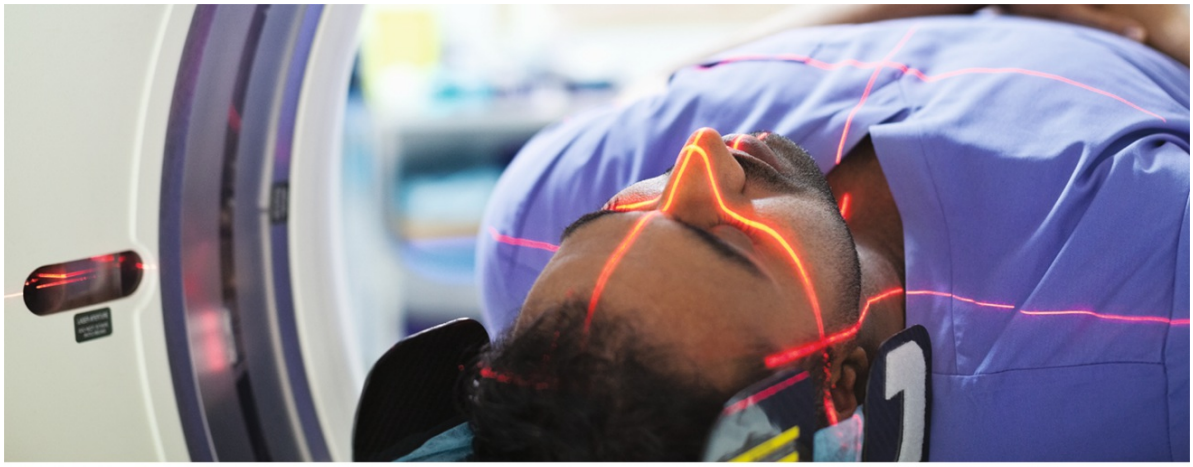
7. Analyzing data through the use of _____ allows researchers to describe and measure relationships between variables.

8. Researchers are able to conclude more broadly from their results through the use of _____ statistics.

9. Before a researcher can test his hypotheses by collecting data, a(n) _____ must provide ethical oversight.

10. Protecting the identity and information collected from individual respondents in a research study refers to maintaining _____.

CHAPTER 3
Neuroscience



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CHAPTER OUTLINE

How Do Scientists Study the Nervous System?

LEARNING OBJECTIVE 1 Understand the key methods that scientists use to learn about nervous system anatomy and functioning.

How Is the Nervous System Organized?

LEARNING OBJECTIVE 2 Name and describe the functions and subdivisions of the two major parts of the nervous system and become familiar with current research in spinal cord injury.

Structures of the Brain

LEARNING OBJECTIVE 3 List key structures of the brain and describe their relationships to our behaviour.

How Does the Nervous System Work?

LEARNING OBJECTIVE 4 Describe the two major types of cells in the nervous system and describe the primary functions of each.

How Do Neurons Work?

LEARNING OBJECTIVE 5 Describe what happens when a neuron "fires" and how neurons communicate with one another to produce behaviour, become familiar with neural networks and neuroplasticity.

CNS Injury and Brain Lateralization

LEARNING OBJECTIVE 6 Explore the neuroscience findings regarding brain injury and the evidence for brain lateralization.

Evolution and the Nervous System

LEARNING OBJECTIVE 7 Describe the basic theory of evolution and explain how it has influenced our understanding of the human nervous system and the evolution of the human brain.

Some people believe that once scientists figure out the human brain and nervous system, all of our experiences—our thoughts, our feelings, our plans and strategies, our ups and downs—will be explained by our understanding of the actions and interactions of the neurons (cells of the brain) in our brain and nervous system. With this level of understanding of the nervous system, we may be able to control or adjust any facet of our experience. How does this sound to you? Do you think it would be a good thing if we could? Some are even claiming that discoveries in the area of **neuroscience** will eventually lead to immortality!

neuroscience the study of the brain and the nervous system.

In his book, *The Dream of Eternal Life*, Mark Benecke (2002) states that cellular life and death determine the aging and time of death of human beings. Benecke (2002) examines why we age and die and speculates about alternative routes to immortality, including cloning, brain and head transplants, and cryonically freezing humans for regeneration in the future. Are these techniques something arising from science fiction or could they become a reality? Brain and head transplants involve removing the brain or the entire head of one organism and transferring it to the body of another. This work has been attempted with animals with nominal degrees of success but it has never been attempted with humans. The human HEAVEN project, the brainchild of neurosurgeon Dr. Sergio Canavero (see photo), proposes to finally attempt the transplant of a human head to the body of another person. The ethics and likelihood of success of this venture were hotly being debated as this was being written (Canavero, 2013; Canavero & Ren, 2016; Garasic & Lavazza, 2017; Lamba, Holsgrove, & Broekman, 2016; Ren & Canavero, 2017). Similarly, cloning has been successfully carried out with many species but to date efforts at human cloning have been restricted to creating embryonic stem cells for research, and as with head transplantation, the ethical issues of whether human clones should be created is an area of constant debate (Ethics Committee of the American Society for Reproductive Medicine 2016) (Tachibana et al., 2013).

Jeff J Mitchell/Getty Images News/Getty Images

The HEAVEN Project Dr. Sergio Canavero, a neurosurgeon, has recently proposed the human HEAVEN project, which will attempt to transplant a human head to the body of another person.

But what about preserving your dead body in liquid nitrogen to wait for the day that future technology will restore you to full health? Perhaps you have heard that Walt Disney, who died of lung cancer following a three-pack-a-day smoking habit, was cryopreserved and is currently in storage under the *Pirates of the Caribbean* attraction in Disneyland? Not so. Approximately 200 people worldwide are currently in cryonic suspension but Walt Disney is not one of them. He was cremated (Mikkelson & Mikkelson, 2007).

With the advancement of technology, maybe we don't even need a human body to preserve who we are. As you will learn later in this chapter, our nervous system runs on tiny electrical signals between cells called neurons. These electrical signals from our nervous system can be interpreted by computers. Neurons have actually been grown on computer chips and learned to fly jets, though only in simulation (Wood, 2004). At some future date, it may be possible to download who we are into a robot-like Sophia, the first robot in the world to receive citizenship (see photo), created by Hanson Robotics (Retto, 2017; Weller, 2017). While we don't yet have computers powerful enough to download all of the activity occurring in a human brain, even during a few seconds of time, it may be possible one day. Would you be willing to extend your life by being downloaded into a computer? How would your family and friends feel about your biological self living inside a machine? If you decided to become part of a machine, when would be the optimal time to do this download: in your 40s or 50s? Earlier? Later? Would you be willing to cut the potential of your human, biological life short to preserve who you are inside a machine, before your brain ages too much?

zixia/123 RF

Sophia Hanson Robotics has produced Sophia, the first robot to receive citizenship of a country. It can interact and have conversations with others, and even display humour.

Life and death are tied to the development of the body and of the brain. For many of the hypothesized routes to immortality we are not yet technologically advanced enough to carry these out and have not deeply considered the ethical, legal, and social impacts of implementing such methods. But even if these were viable techniques would you choose to use them? Think as you read this chapter about how your nervous system makes you the person you are. After being cryonically preserved for two or three hundred years in a vat of liquid nitrogen would you be the same when revived? Would you become the same person you are today if your DNA were cloned and you began again as an infant? What if your brain was in the body of another person, or the workings of your brain were transferred to the circuitry of a computer, or a robot like Sophia? Would you still be the same person you are now?

In this chapter we examine many established findings about the biological underpinnings of psychology. However, you will also see that, although considerable progress has been made in understanding the organization and function of the brain, there remain large gaps in our knowledge about how the actions of the billions of microscopic cells in the brain and body produce complex behaviours such as thought and personality. For example, researchers have yet to build a machine able to exhibit the conscious awareness experienced by humans (Reggia, 2013). That is, a machine (or computer/robot) can identify a rose but it is unable to consciously experience the colour red or the smell of the rose; nor can a machine understand language, feel emotion, or think about itself. Why do you think that is the case? With advances in technology, will consciousness in a robot be possible one day? What will that say about the uniqueness of who we are as a human species? As you read about the physical structure of our nervous system and brain, consider what in this extraordinarily complex system makes you "*you*."

In subsequent chapters, we will return to concepts such as consciousness, language, and

emotions, but in this chapter we will focus on the biological nervous system that is the basis for all of your thoughts, feelings, and behaviours. Although considerable progress has been made in understanding the organization and function of the brain, there remain large gaps in our knowledge about how the actions of the billions cells in the brain, and their trillions of connections, produce complex behaviours, such as thought.

How Do Scientists Study the Nervous System?

LEARNING OBJECTIVE 1

Understand the key methods that scientists use to learn about nervous system anatomy and functioning.

Imagine that you are a researcher and have decided to study the brain and our nervous systems. The human brain weighs about 1400 grams (about three pounds) and is made up of soft jelly-like tissue, in some ways similar to the appearance of uncooked chicken. Other than seeing bumps (called gyri) and grooves (called sulci) on the surface, it is the same basic colour overall, with few defining features (see photo). How do you study a three-pound lump of fat and tissue, and its control of who you are and what you do, when there are no obvious working parts? Scientists have grappled with this problem for centuries. It has only been in the last several decades, with advances in fields like computer science, engineering, and physics, that we now have advanced microscopes and machines that allow us to "see" inside the working brain.

OTIS HISTORICAL ARCHIVES, NATIONAL MUSEUM OF HEALTH AND MEDICINE/SCIENCE PHOTO LIBRARY

What made Albert Einstein's brain special? Albert Einstein's brain when compared to the brains of most people doesn't look all that different on the surface, yet he was a genius who revolutionized the fields of math and physics. What made his brain special? We will never really know, since the only information we have about how his brain functioned is from looking at it post-mortem or after death and this tells us very little about how his brain worked when he was alive.

In the past, researchers of psychological issues in humans often avoided analyzing the brain, mainly because of limits in our study methods and technologies. Until recently it was difficult, if not impossible, to study what goes on in the human brain without causing damage to brain tissue (Chudler, 2011). Over the last several decades, and even centuries, human neuroscientists and biopsychologists relied largely on one of the following methods:

Examining autopsy tissue. This method allows neuroscientists to see what our brains look like, but has the obvious drawback of telling them little about how these systems worked when the person was alive and using them (Love, 2004).

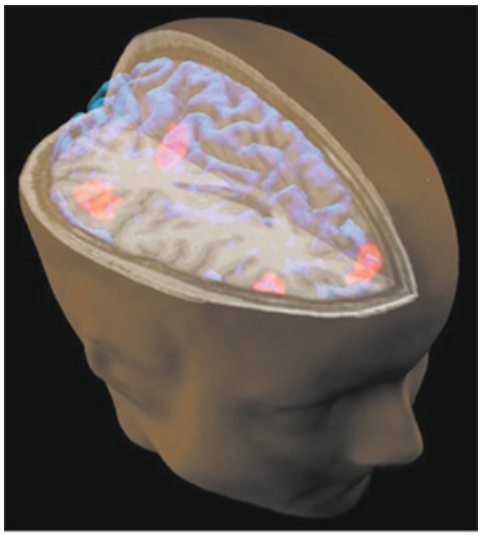
Testing the behaviour of patients with assumed damage to certain parts of the brain. Scientists called *neuropsychologists* have learned a great deal about the brain from studying patients with brain damage. Patients with localized brain damage often have loss of some particular function. The type of loss of function then suggests what the brain region did before it was damaged. Therefore this approach relies on inference. That is, the neurophysiological approach involves researchers making assumptions based on information about how the brain normally functions from the behavioural changes resulting from damage to the brain. It is important to keep in mind, however, that researchers are unable to compare the undamaged brain of a given individual with the same person's damaged brain and so cannot make statements about cause and effect. Patients with localized brain damage may have smaller undetectable abnormalities in other areas of the brain that could be affecting their behaviour. Or, it could be that a pathway carrying information to or from the area related to the lost function has been damaged, rather than a specific area itself. Also, the damaged brain may undergo reorganization of its circuitry over time so abnormalities in behaviour may not reflect what goes on in the intact brain (Guggisberg, Koch, Hummel, & Buetefisch, 2019; Termenon, Achard, Jaillard, & Delon-Martin, 2016). It is often only when examining the brain after death that the correlation of a specific site of brain injury with a particular behavioural change can be confirmed, as we will see in the section CNS Injury and Brain Lateralization later in this chapter.

Recording electrical brain activity through multiple electrodes attached to the surface of the scalp. Scientists have used *electroencephalograms*, or EEGs, as a non-invasive way to measure or learn about the activity of our brains during certain states (awake and asleep) and during certain behavioural tasks, (Lomas, Edginton, Cartwright, & Ridge, 2014) to make predictions about the functional effect of brain injuries, and to identify types of seizure disorders (Ahmadlou & Adeli, 2011; Breedlove & Watson, 2020). (See photos.) The drawback of this type of monitoring of brain activity is that surface recordings provide only a summary of surface brain activity just under the scalp—pinpointing the location of activity using this method can be done only in a general sense. Over the last several decades researchers have refined the electroencephalographic technique by analyzing *event related potentials* (ERP). A computer notes when a sensory, cognitive, or motor event takes place and the experimenter can then analyze the wave patterns that occurred at the time of, and following, the behavioural event. For example, ERP methodology is a useful approach for examining central nervous processing activities, such as audition in nonverbal infants (Hoehl & Wahl, 2012). In such cases, the infant's brain reactions, or electrical activity, to sound stimuli are measured in order to assess the infant's ability to process

the stimuli. This technique allows researchers to know exactly *when* events take place and where there is an increase in brain activity just under the skull. This technique is not ideal for identifying *where* in the brain activity occurs if it is deeper in the brain, because the skull, and the surface layer of brain itself, can interfere with recording electrical activity from deep in the brain.

Aaron MCcoy/Getty Images

Electroencephalography (EEG) Electroencephalography is a non-invasive technique used to detect and localize electrical activity in the brain.



Courtesy Leigh Nystrom & Jonathan Cohen, Princeton University

The brain at work This 3D computer-generated image of a human brain shows areas of brain activation (coloured areas) in an individual undergoing a moral decision-making task.

Animal studies. Studies of animal nervous systems allows researchers to look at the structure, function, and activity of specific areas of the brain. This type of work can also be done at the individual cell level. Researchers can examine specific brain regions, record electrical activity from specific brain areas or specific neurons, temporarily activate or deactivate parts of the brain and observing the outcome. Scientists can also target specific brain areas for destruction and observe the effects on

behaviour after injury—a process called *lesioning* (Hilton et al., 2013). While animal studies have been extremely important for understanding the general principles of brain function at the cellular and structural level, these nervous systems are still not a human nervous system. To truly understand how the human nervous system works, we need techniques that allow for study of the structural and functional aspects of the human brain and nervous system.

Over the past few decades new **neuroimaging** techniques have been developed to study brain activity. These methods include magnetic resonance imaging and functional magnetic resonance imaging (MRI and fMRI; see illustration), computerized (or computed) axial tomography (CAT or CT), positron emission tomography (PET) transcranial magnetic stimulation (TMS), and diffusion tensor imaging (DTI). (See images.)

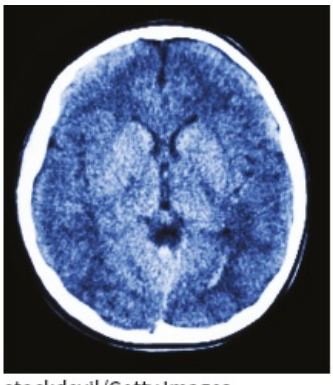
> **neuroimaging** techniques that allow for studying brain activity and structure by obtaining visual images in awake humans.

Computed tomographic scans (CT scans) produce clear, detailed, two-dimensional X-ray images of the brain or other organs. Computer combination of many X-ray images taken from multiple angles results in a three-dimensional brain image that can be virtually "sliced" and examined from any angle. CT images provide greater detail than traditional X-rays.

Instead of X-rays, *magnetic resonance imaging* (MRI) uses a strong magnetic field to produce three-dimensional images of the anatomy and physiology of the brain. MRI scans produce much clearer images than CT scans and do not use radiation as a CT scan does.

So if the MRI has lower risks associated with it and it produces a better image, why use a CT scan at all? There are several reasons: CT scans are better at detecting problems, such as strokes or blood vessel abnormalities, in certain parts of the body such as the brain. As well, CT scans are the preferred method for identifying many forms of cancer, whereas MRIs are better at detecting soft tissue injuries in tendons and ligaments, as well as injuries to the spinal cord or brain (see Psychology Around Us 3.1). CT scans are also faster to administer and so are useful in emergencies, and they cost less. As well, an MRI cannot always be used; for example, people who have pacemakers, shrapnel, or other metal in the body or those with certain types of injuries cannot be examined using a powerful magnet. In accidents involving metal, such as car accidents or work-related accidents, the magnet can rip the object free, causing further injury or death.

(a)



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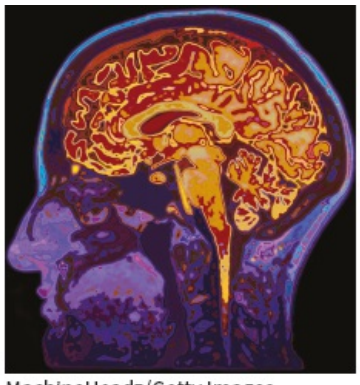

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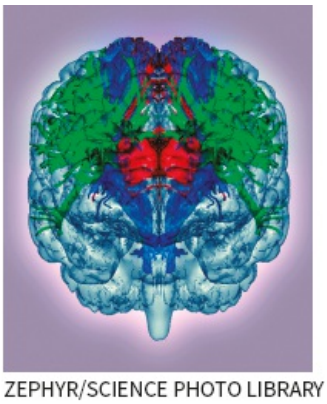

ZEPHYR/SCIENCE PHOTO LIBRARY

Neuroimaging (a) Computed axial tomography (CAT) scan, (b) magnetic resonance imaging (MRI), and (c) diffusion tensor imaging (DTI). Note: When looking at images of the brain, keep in mind that the colours you see in images (b) and (c) are added by a computer. The colours of brain imaging scans, regardless of technique used, look more like the brain in image (a).

3.1 Psychology Around Us

"Mild" Brain Injury

Icon Sportswire/Getty Images

Sidney Crosby Pittsburgh Penguins' Sidney Crosby hits the ice after a collision during an exhibition game in 2013.

Repeated mild traumatic brain injuries (mTBI), particularly when associated with loss of consciousness, can lead to a concussive- or subconcussive-related degenerative brain disease called chronic traumatic encephalopathy (CTE) (Levin & Smith, 2013). Repeated traumas may cause the death of neurons and may lead to the progressive buildup of abnormal proteins called tau proteins within months to decades following the injury. CTE is associated with a constellation of neurocognitive symptoms, including personality change, memory loss, progressive dementia, mood swings, confusion, tremors, speech and gait abnormalities, depression, and suicidal ideation and completion. The presence of CTE has been confirmed through autopsy in the brains of professional and amateur athletes, members of the military exposed to blasts in combat, and others who have experienced repetitive mild head injuries (McKee et al., 2016, 2013, 2009).

The development of CTE following even repeated and severe concussion is not inevitable. Researchers at the University of Toronto report that some athletes who have experienced multiple concussions never develop CTE and therefore they argue that the causes for this neurocognitive degenerative disease are as yet unclear (Hazrati et al., 2013). Since CTE can be definitively diagnosed only after death, athletes and others at risk have no way of knowing if slips of memory or bouts of depression are

early signs of CTE or have a less ominous explanation, such as stress or fatigue.

Gary Small and colleagues at the Semel Institute for Neuroscience and Human Behavior at UCLA have therefore developed what they hope will become a non-invasive means of diagnosing (or eliminating) the presence of abnormal tau proteins in living individuals with suspected CTE (Small et al., 2013). In this procedure, a radioactive isotope called FDDNP is injected into the bloodstream where it binds to abnormal tau proteins; a PET scan is then used to identify where these abnormal tau proteins have accumulated in the brain. Small and colleagues report identifying higher levels of FDDNP in regions of the brains of athletes with suspected CTE similar to patterns previously observed at autopsy in affected athletes' brains. The tau binding patterns in the affected athlete's scans involved areas of the brain associated with learning, memory, and emotion. The hope of Small and other researchers is that this non-invasive approach will be used for early detection, which will in turn lead to treatment and prevention. Members of the National Institute of Neurological Disorders and Stroke as well as members of the National Institute of Biomedical Imaging and Bioengineering have gathered to identify criteria for detecting early signs of CTE (McKee et al., 2016).

But others, including many professional athletes, are arguing that traumatic brain injury, particularly in sports, is completely preventable. They are therefore calling for changes to rules in their respective leagues to reduce or eliminate the risks of repeated concussions to players. Players such as Pittsburgh Penguins' Sidney Crosby, who famously suffered from recurrent post-concussion symptoms for well over a year following two consecutive blows to the head, are at considerable risk for severe neurological injury. In fact, it turns out that for many, these repeated "mild" brain injuries can be deadly.

Diffusion tensor imaging (DTI) is one of the newest structural imaging techniques. It measures the orientation and integrity of white matter (described later in the chapter) to assess damage in the brain and with the assistance of a computer, it produces a DTI colour map. Research indicates that white matter damage is involved in a number of brain disorders (Shenton et al., 2012). For example, mild traumatic brain injury (mTBI), also called concussion, is difficult to diagnose as the brain often appears normal on CT or MRI scans because these more conventional techniques do not assess white matter injury.

Structural images are very helpful but they do not enable researchers to identify brain regions that become active under specific conditions. Functional neuroimaging tells us about activity in particular brain areas during specific behaviours. As discussed previously, the EEG is a technique that examines brain function but allows us to visualize and localize it very crudely. Current detection methods include transcranial magnetic stimulation, positron emission tomography, and functional magnetic resonance imaging, which provide better measures of brain activity than a traditional EEG.

Transcranial magnetic stimulation (TMS) delivers an electromagnetic pulse to a targeted brain area, temporarily disrupting brain activity in a conscious person (Horvath et al., 2013). If following an electromagnetic pulse (i.e., the "temporary lesion") to a specific brain area a person shows impaired task performance, the assumption is that the affected brain

area must be involved in that particular task. This alteration of brain activity is very brief, milliseconds or seconds, and does not create any lasting changes in the brain.

Positron emission tomography (PET) is a procedure used to see the activity of the brain overall during a cognitive task. Radioactive chemicals are injected into the bloodstream, which are taken up by the brain. One chemical that is often used is radioactive glucose (the dose of radioactivity is very small and not harmful) (Mitelman et al., 2018). Since glucose provides the energy the brain uses, the part of the brain that is more active during a behaviour or cognitive task will use more glucose. Sensors for radioactivity in a PET scanner surround the head and pick up where the highest amount of radioactivity is being released from the brain. This signal is processed by a computer to triangulate the signal to the areas of the brain most active (Caletti et al., 2017). This technique has advantages over techniques like EEG, since it allows researchers to measure activity at deeper levels of the brain than the surface. It also allows scientists to use different chemicals with radioactive tags to study the activity of specific neurochemicals within the brain (Ayubcha et al., 2020). For example, with PET signalling, we can see exactly where chemicals like dopamine and serotonin are being used in the brain. (We'll learn more about these chemicals in the section How Do Neurons Work? of this chapter.) PET can also be used to see subtle changes in brain activity with chronic brain injury such as that described in Psychology Around Us 3.1 (Caminiti et al., 2019; Omalu et al., 2018).

Functional magnetic resonance imaging (fMRI) has changed the way neuroscientists understand brain structure and activity within a single brain. It combines the clarity of MRI scanning of neuroanatomy with a measure of activity (Andoh et al., 2017; Craddock et al., 2012). This powerful combination allows scientists to pinpoint with high precision which areas of the brain are active during specific tasks. This is done by measuring the use of oxygen in specific areas during a brain scan. Just like glucose use, when a brain area is more active, it requires more oxygen. This increase in oxygen use is coupled with an increase in blood flow (called a BOLD signal: blood oxygen level dependent) in the area with heightened activity. fMRI scanners allow for the creation of detailed maps of the structure of a person's brain and the superimposition of activity maps showing which areas of the brain have increased blood flow and oxygen activity in the same brain! This can be useful for studying changes in an individual's brain with development, age, and injury (Geerligs, Tsvetanov, & Henson, 2017; Wang, Mantini, & Gillebert, 2018). If the technology is available, fMRI is preferable to PET because it does not require radiation and is also able to quickly detect changes in brain activity.

The availability of these neuroimaging technologies has produced an explosion of research in understanding how human and animal brains work. However, there are advantages and disadvantages with each structural and functional imaging technique. For example, PET scanning can tell you about activity in the brain over much longer time periods, such as hours and even days, whereas fMRI scanning may only give us information about the activity of the brain in minutes and hours. EEG, while not great at providing information about where activity is occurring deep in the brain, is really good at recording what is happening in the brain within milliseconds of a change in brain activity. It is important when studying the brain and how it works to think carefully about which techniques are the best ones to answer different types of structural and functional questions. A scientist also has to consider the cost and accessibility of the technique they would like to use. It

may be ideal to use an fMRI, but if a CT scanner is all a person has access to, then the research questions asked need to be designed to maximize the use of the technology available. Ultimately, it is the creative combination of various imaging technologies, such as combining transcranial stimulation with positron emission tomography, that will allow scientists to continue to expand our understanding of how our brains and nervous systems work (Kraus et al., 2020). For an historical look at one of the key Canadian figures, Dr. Wilder Penfield, in the field of neuroscience and the development of neuroscience techniques please see Your Brain and Behaviour 3.1. The Psychology@Work video on Consumer Psychology shows another uniquely human brain feature relating to how consumers process purchasing preferences in ways that they do not fully comprehend or understand.

Video **PSYCHOLOGY@WORK**

Consumer Psychology **This video looks at work in the industrial/organizational psychology area of neuromarketing. It shows that while people often cannot answer questions about their preferences accurately, their brain responses are better indicators of their likes and dislikes.**

3.1 Your Brain and Behaviour

Dr. Penfield, I Can Smell Burnt Toast!

There is arguably no one who has had more influence on our understanding of the brain, neuropsychology, and neurosurgery, in Canada and worldwide, than Dr. Wilder Penfield. While he was alive he was considered "the greatest living Canadian" for his groundbreaking work in understanding how the brain works. To give you a sense of his importance to the field of neuroscience, Google celebrated him with a Google Doodle on January 26, 2018, in honour of what would have been his 127th birthday (https://www.google.com/doodles/wilder-penfields-127th-birthday).

Dr. Penfield studied at Princeton University followed by medical school at Johns Hopkins School of Medicine, where he began developing neurosurgical techniques to treat epilepsy. He received an invitation at the beginning of his career to practise medicine in Montreal by Sir Henry Vincent Meredith, the president of the Bank of Montreal. In 1934 Dr. Penfield, along with Dr. William Cone, founded the Montreal Neurological Institute and Hospital (MNI) with funding from the Rockefeller Foundation. Today this world-class facility is known as The Neuro. While at the MNI Dr. Penfield, along with Dr. Herbert Jasper, continued to develop techniques to perform neurosurgery on patients while they were conscious. (This can be done because there are no pain receptors in our brain tissue and the skin covering our skulls can be anaesthetized with local anaesthesia.) His neurosurgical procedure, which he called "The Montreal Procedure," is the basis for neurosurgery in conscious patients today.

In awake patients, using small currents of electricity, Dr. Penfield could stimulate specific parts of the brain and record the experiences the patients recounted. For

example, by stimulating sections of the temporal lobe, he enabled his patients to narrate vivid memories that they were re-experiencing during surgery. This work laid the foundation for our current understanding of localization of function in the brain. Dr. Penfield developed the first maps of the cortical homunculus (shown in **Figure 3.6**) and was a pioneer in deciphering which areas of the cortex were responsible for things such as how we experience the world through our movement and sensory systems.

Source: Richard Arthur Norton. https://commons.wikimedia.org/w/index.php?curid=17997098, License under CC0

Science History Images/Alamy Stock Photo

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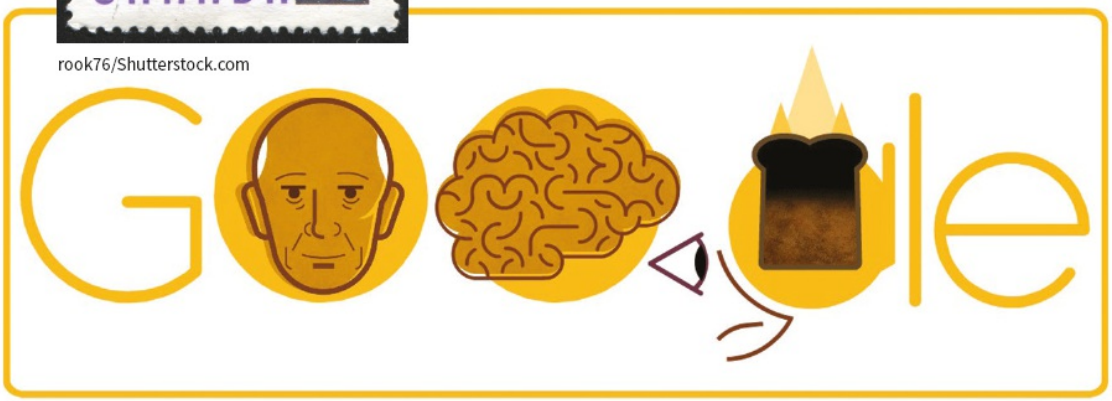


Source: Google.com

Dr. Wilder Penfield Dr. Penfield is shown as a young man at Princeton University and later in life after he had gained recognition as a neurosurgeon. His contributions to neuroscience have been commemorated as a Canadian stamp in 1991 and more recently as a Google Doodle (dated January 26, 2018) on what would have been his 127th birthday.

Dr. Penfield may be best known for his groundbreaking work treating patients with epilepsy. Epileptic seizures are caused by the overexcitability of neurons. Dr. Penfield,

by electrically stimulating the brain in precise locations typically in the temporal lobe, could often find the initial location of the heightened neural activity that causes a seizure. This area of the brain can then be carefully removed and in many cases the seizures will stop. His treatment for epilepsy was immortalized in the minds of many Canadians with the production of a Heritage Minute television clip showing a re-enactment of his surgical technique. When his patient exclaimed "Dr. Penfield, I can smell burnt toast!", he knew he had found the origin of his patient's seizures in her brain. Prior to a seizure, many people will experience a particular sensory experience like a smell. This experience, when felt in the operating room, gave Dr. Penfield the information he needed to localize the origin of a patient's epilepsy, allowing him to remove this area of brain tissue that was at the centre of their disorder.

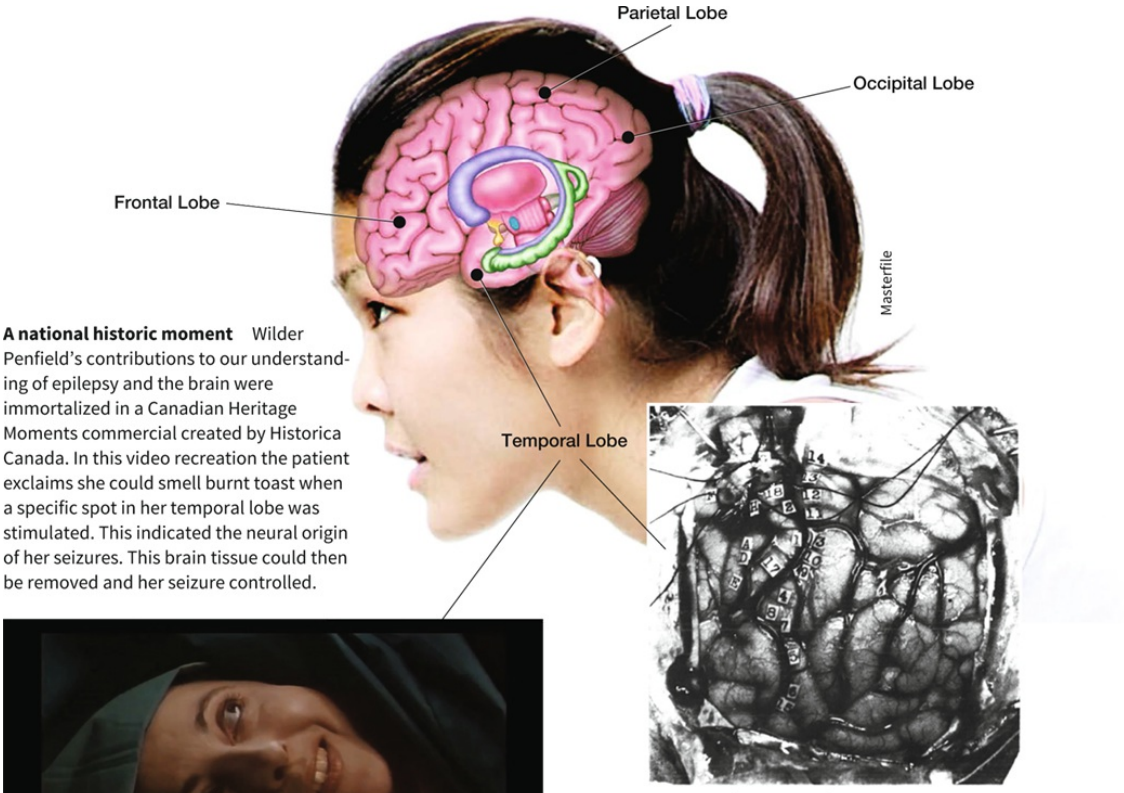
By Dr. Penfield's own observations, however, he never stimulated a sense of reason, calculus, a random abstract thought, or intelligence. Our understanding of how these phenomena are coded in the brain only becomes clearer with the neuroscience research that has been conducted since his seminal work in the 1960s. Dr. Penfield was given several honours during his lifetime, including the designation as a Canadian National Historic Person in 1988. A federal historic marker from the Canadian Historic Sites & Monuments Board and Parks Canada can be found commemorating his work at 740 Dr. Penfield Avenue on the McGill University campus in Montreal.

Questions

Why is Dr. Wilder Penfield considered a Canadian National Historic Person?

What neurosurgical technique did Dr. Penfield invent and why is it important?

Which areas of the cortex did Dr. Penfield map during his stimulation of the brain during neurosurgery?



A national historic moment Wilder Penfield's contributions to our understanding of epilepsy and the brain were immortalized in a Canadian Heritage Moments commercial created by Historica Canada. In this video recreation the patient exclaims she could smell burnt toast when a specific spot in her temporal lobe was stimulated. This indicated the neural origin of her seizures. This brain tissue could then be removed and her seizure controlled.

HISTORICA CANADA

Source: McGill University Library

Inside the living brain In this image a living brain can be seen with the skin and skull surrounding it. The numbers on the brain correspond to spots that Dr. Penfield would have electrically stimulated. Any behaviours that occurred in conjunction with the stimulation of these different areas would have been carefully recorded. It was the stimulation of the temporal lobe that often generated seizures in Dr. Penfield's epileptic patients.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

1. Describe how studies of people with brain damage and EEGs have contributed to our knowledge of the brain and nervous system.

2. What are the main advantages of neuroimaging methods over earlier neuroscience research methods?

3. Compare and contrast the different types of structural and functional techniques currently available for imaging the brain. What are the strengths and weaknesses of each technique?

What Do You Think? • Do you think it will eventually be possible to use neuroimaging techniques to determine what a person is thinking? What would be the ethical implications of using this technology?

How Is the Nervous System Organized?

LEARNING OBJECTIVE 2

Name and describe the functions and subdivisions of the two major parts of the nervous system and become familiar with current research in spinal cord injury.

Our nervous system controls everything we do, both consciously and unconsciously. It controls the actions we are aware of, such as texting a friend or making a burrito or falafel for lunch, and the actions we are often unaware of, such as how fast our hearts are beating while watching a horror movie, or the movements we make in our favourite chair as we get comfortable while chatting with a friend. As shown in **Figure 3.1**, the human nervous system can be divided into two main components: the central nervous system (CNS) and the peripheral nervous system (PNS). The *central nervous system* consists of the brain and spinal cord. The *peripheral nervous system* is made up of all the nerves throughout our bodies that deliver information back and forth between the periphery and the central nervous system. **Neurons** are the cells that carry information between the various parts of our bodies and nervous systems. Neurons that carry signals from the PNS to the CNS are called **afferent neurons**. Neurons that carry signals from the CNS to the PNS are called **efferent neurons**. **Interneurons** are neurons that connect two or more neurons. For example, a signal produced by an afferent sensory neuron in the skin near your ankle would be communicated via one or more interneurons, often found in the spinal cord, before it reached a neuron in a sensory area of the brain.

neuron a nerve cell.

afferent neurons neurons that carry sensory information from the body to the CNS.

efferent neurons neurons that carry information out from the CNS to the muscles and glands.

interneurons neurons that typically have a short axon and serve as a relay between different classes of neurons; in the spinal cord, interneurons communicate with both sensory and motor neurons.

The Peripheral Nervous System (PNS)

The peripheral nervous system consists of the somatic nervous system and the autonomic nervous system. The **somatic nervous system** is made up of all of the nerves that gather sensory information (typically about touch and pain) from all over the body, neck, and head and deliver it to the spinal cord and brain, as well as the nerves that send information about movement from the CNS to the muscles of the body, neck, and head. The main function of the PNS is to send information to and receive information from the CNS.

somatic nervous system all the peripheral nerves that transmit information about

body sensation and movement to and from the central nervous system.

By contrast, parts of the **autonomic nervous system** operate mostly without conscious control or thought by the CNS. The autonomic nervous system can be subdivided into two parts: the *sympathetic nervous system* and the *parasympathetic nervous system*. Both components of the autonomic nervous system are made up of collections of nerve cells distributed throughout the body. However, they serve opposing functions. The sympathetic nervous system is activated under conditions of stress, whereas the parasympathetic nervous system is inhibited during those times, but is active during more restful times.

autonomic nervous system portion of the peripheral nervous system that comprises the sympathetic and parasympathetic nervous systems.

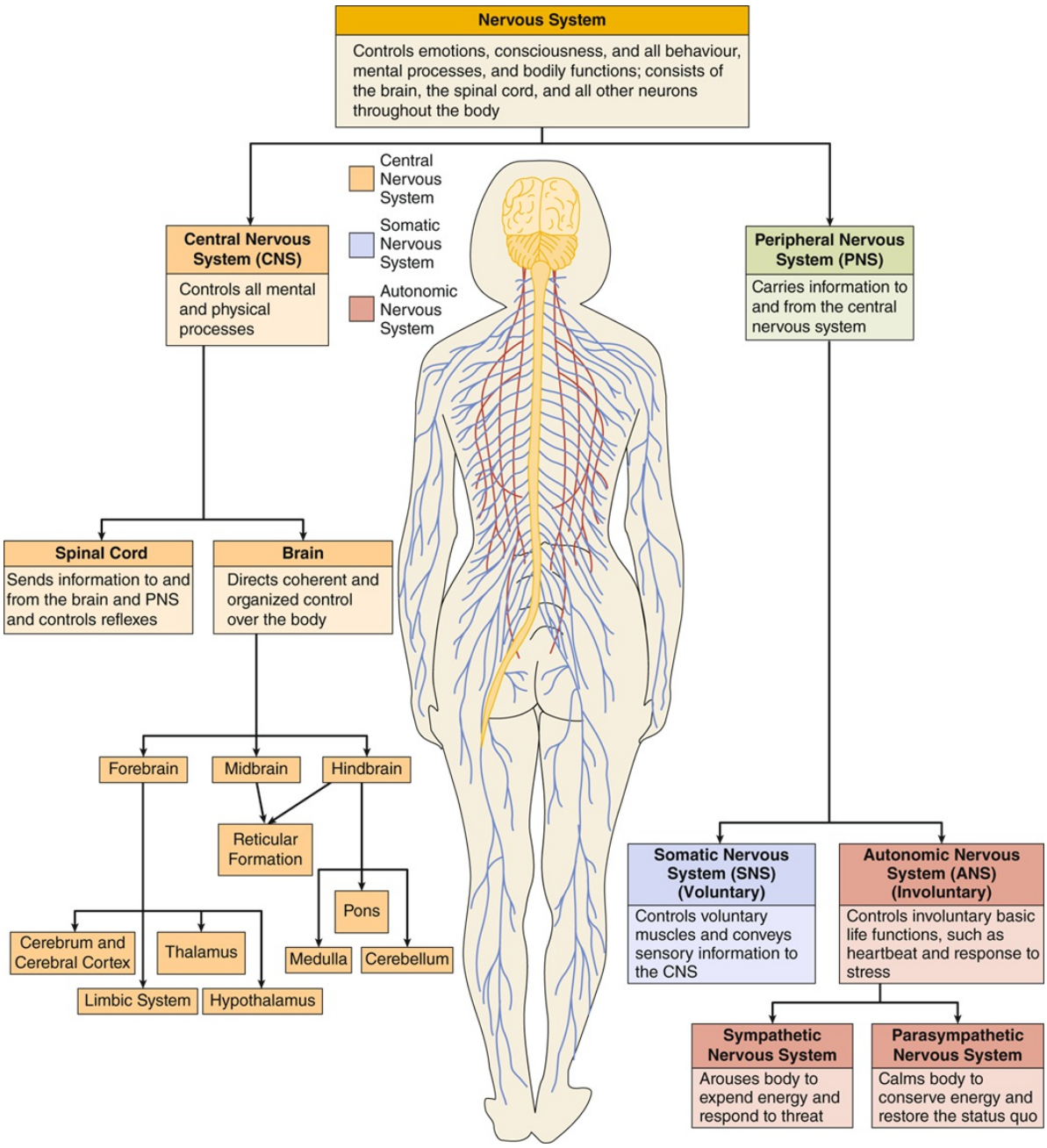


FIGURE 3.1 Organization of the nervous system The nervous system is divided into the central nervous system (consisting of the brain and spinal cord) and the peripheral nervous system (consisting of the somatic nervous system and the autonomic nervous system). The autonomic nervous system is further subdivided into the sympathetic and parasympathetic nervous systems. Source: Reprinted with permission of John Wiley & Sons, Inc., from Huffman, K. (2010). *Psychology in Action*, 9th edition. Hoboken, NJ: Wiley, Figure 2.4, p. 60.

The **sympathetic nervous system** is responsible for the "fight-or-flight" reaction, the physiological response that enables us to respond to potentially life-threatening situations. Imagine that you are hiking on what you know to be a safe path in the woods and you hear

rustling behind you. You turn to look, but cannot see anything. You chide yourself for being imaginative and continue walking, but then you hear the rustling again; this time it is closer. Your sympathetic system activates at this point: Your pupils dilate to maximize the amount of light entering your eyes, your heart rate and respiration increase so you can get more oxygen to your muscles, glucose is released into your system to provide energy to your muscles, your blood pressure increases and blood flow is diverted to your brain and muscles. Non-essential functions—that is, those activities not devoted to helping you survive (such as digestion)—are slowed down or stopped entirely. At this point you see a bear and drop your bag, sprinting to the nearest tree, quickly climbing it. Once the emergency has passed, the **parasympathetic nervous system** takes over and helps reverse the effects of the sympathetic system to return the body to its normal resting state. Once the bear has opened your pack, eaten your lunch, and ambled away, your heart rate slows, your breathing normalizes and eventually you feel safe enough to climb down from the tree. Since the parasympathetic system returns the system to its resting state it is sometimes called the "rest and digest" system (Lang &Bradley, 2013).

> **sympathetic nervous system** the part of the autonomic nervous system that is activated under conditions of stress.
>
> **parasympathetic nervous system** the part of the autonomic nervous system that is active during restful times.

Sometimes the sympathetic nervous system is activated when humans are not necessarily at risk of bodily harm, but are in social situations where the major fear is one of embarrassment and humiliation, such as presenting in front of a class or giving a speech at a friend's wedding (Rash & Prkachin, 2013). Have you ever given a speech in front of a group of people? Many people experience a strong stress response to such situations. They develop a rapid heart rate, increased respiration, and a dry mouth, signs that the sympathetic nervous system has activated and a clear example of stress activating physiological systems.

The Central Nervous System (CNS)

As we have noted, the CNS consists of the spinal cord and the brain. The **spinal cord** extends from the base of the brain down the back, inside the bony spinal column. The spinal cord is critical for gathering sensory and movement information from the body and sending it to the brain, as well as for enabling the brain to send signals back to the body to control how it moves.

> **spinal cord** portion of the central nervous system that extends down from the base of the brain and mediates sensory and motor information.

The somatic nervous system operates in concert with the CNS to integrate sensory signals with motor output. In most cases, this integration involves the brain (voluntary movement, for example, requires brain involvement). However, some very basic functions, including reflexes, involve just the somatic nervous system and the spinal cord.

Have you ever stepped on something sharp, such as a tack, and pulled your foot back before

you even had a chance to yell “ouch”? This movement of pulling your foot away occurs even before your brain becomes aware of the pain from stepping on the tack. This rapid reaction is the result of activity of a pain reflex circuit of your spinal cord, as shown in **Figure 3.2**. Simple circuits such as these consist of three neurons—a sensory neuron that sends a signal from the skin into the spinal cord, an interneuron in the spinal cord, and a motor neuron that sends a signal back to the muscles in your leg and foot to pull away from the tack. These simple circuits between the sensory and motor systems in the body, and their connection to one another via an interneuron in the spinal cord, can generate movements without any communication with the brain.

While this reflexive behaviour of pulling your foot away from a tack is in progress, pain information is also travelling up to the brain and enabling you to vocalize about the pain and carry out other movements, such as hobbling to a chair, sitting down, and pulling the tack out. However, these reactions are slower than the reflex because the information must travel greater distances to the brain, where the information is processed and acted upon. In the next several sections of this chapter, we will go into more detail about how these signals between the cells within the nervous system are generated and passed on from the body to the brain.

More complex tasks require the spinal cord and brain to work in partnership. Afferent sensory neurons in the PNS send messages to the spinal cord, which in turn relays the message to the brain. The brain sends commands through efferent neurons to the spinal cord motor neurons, which in turn relay the message to the skeletal muscles, signalling them to contract. Damage to the spinal cord can disconnect the brain from the sensory and motor neurons essential for complex control of sensory and motor function. In the next sections of this chapter we will delve deeper into how neurons function and how the various areas of the brain work together to produce the neural commands that allow us to interact with the world around us.

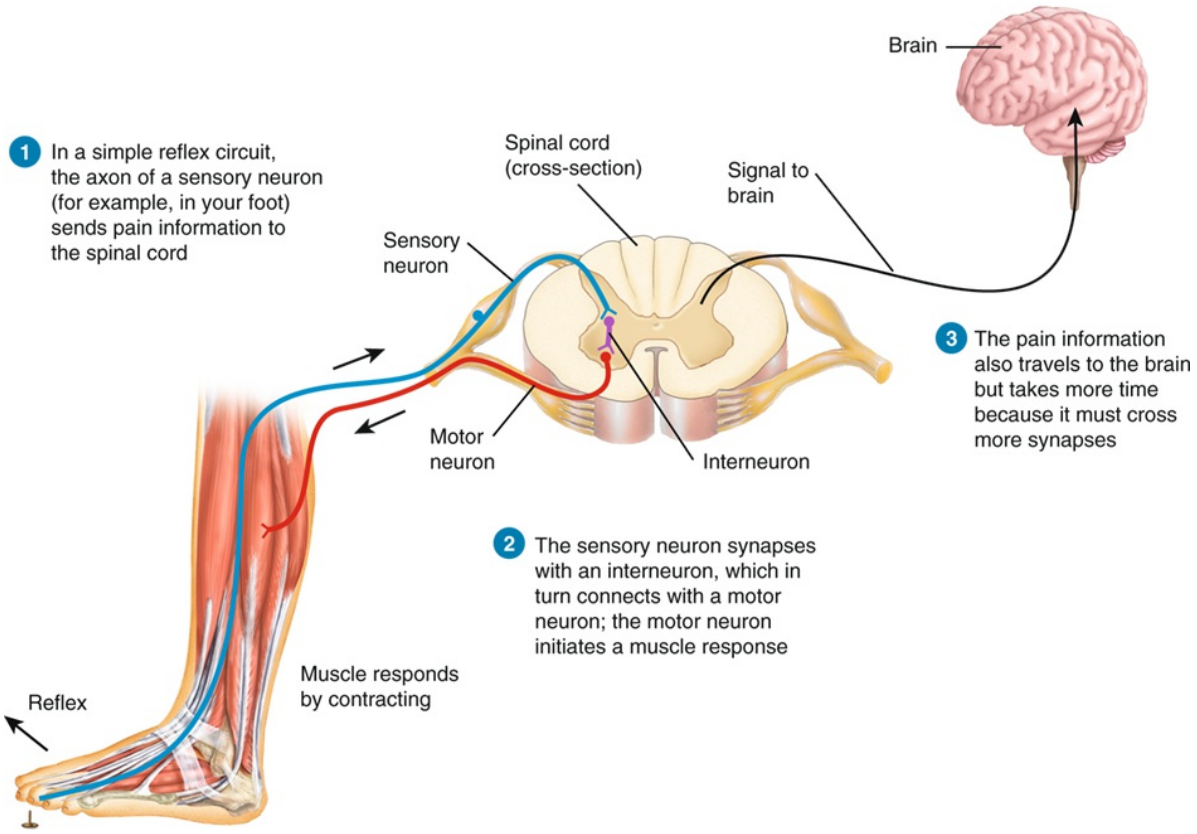


FIGURE 3.2 The reflex circuit of the spinal cord Sensory information travels into the spinal cord along sensory neurons that synapse on interneurons. Interneurons send information to the motor neurons in the spinal cord, which then send impulses back out to the periphery to contract the muscle and induce movement. If you have ever had a doctor use a small hammer to hit your leg just below your knee and your leg kicks out, seemingly without your conscious control, this is a spinal cord reflex in action!

Spinal Cord Injuries

A spinal cord injury occurs when the nerves that make up the spinal cord itself are damaged. As such, it is possible to break your the vertebrae in your neck or your back and not have a spinal cord injury, though the two often occur together. In addition to controlling simple reflexes, the spinal cord is very important for carrying sensory information up to the brain and motor information back out to the body. When the spinal cord is damaged and the flow of information to and from the brain is disrupted, individuals can become paralyzed, and may be incapable of perceiving touch or pain sensations on the body. The higher up the spinal cord the damage occurs (the closer it occurs to the brain), the larger the proportion of the body that is afflicted. Thus, when an individual breaks their neck and permanently damages the spinal cord close to the brain, they lose touch and pain sensation everywhere but their heads and faces and they become *quadriplegic*, paralyzed everywhere but the head and neck. If the damage occurs farther down the back, then they may retain sensation and usage of the upper limbs and torso, but not of the lower limbs; in this case, individuals often are considered to be *parapalegic*.

Spinal cord damage is devastating and currently about 86,000 Canadians are living with some form of spinal injury, with approximately 1,500 new spinal cord injuries a year (Farry & Baxter, 2010). Rick Hansen, a well-known Canadian with a spinal cord injury, began to raise awareness and money for spinal cord research with his Man in Motion world tour in 1985 (see photo). Since then he has established the Rick Hansen Institute, which encourages and supports spinal cord research. Scientists are looking at ways to enhance regeneration of severed axons in the spinal cord, as well as examining the potential for replacing motor neurons destroyed by injury (Bray, 2016).

Derek Leung/Getty Images

Rick Hansen In 1973, at the age of 15, Canadian Rick Hansen was involved in an accident that left him paralyzed from the waist down. In 1985 he embarked on his Man in Motion Tour to wheel over 40,000 km across 34 countries around the world. After the tour, he established the Rick Hansen Foundation to fund research into spinal cord injuries.

Recent success in using epidural electrical stimulation below the site of spinal cord injury to boost the electrical signals being sent from the brain to the lower body has led to some individuals with loss of movement of their legs recovering the ability to walk (Angeli et al., 2018; Minassian et al., 2016). Ryan Straschnitzki (see photo), a survivor of the horrific 2018 bus crash of the Humboldt Broncos hockey team in Saskatchewan, has shown promising recovery from paralysis after receiving a spinal cord epidural stimulator. As of 2020, this technology had not been approved in Canada (Straschnitzki went to Thailand for the surgery), but clinical trials in Canada are underway (Graveland, 2019).

Work with quadriplegics has followed a similar route. New treatments have led to the creation of "neural bypasses" (Bouton et al., 2016; Skok, Tabakow, & Chmielak, 2019). In some instances, a computer chip is implanted on the surface of the brain that records activity in the cortex directly under the chip. This chip "reads" the signals, or commands for action from the brain, and wirelessly sends them to a computer. These signals, such as turning on the TV or altering the temperature in the room, gives the user increased

independence from caregivers. In other instances, a receiver can be placed in a paralyzed part of the body, such as the arm. This receiver receives wireless commands from the brain to move the arm. The electrical signals (just like the ones in neurons) from the receiver stimulate the arm muscles and lead to a motor action, such as moving the arm to pick up a coffee cup (Simeral J.D. et al., 2021).

Progress has also been made in the treatment of spinal cord injury using stem cell therapies. Freda Miller, working at The Hospital for Sick Children in Toronto together with colleagues in Toronto and British Columbia, discovered, using animal models, that stem cells produced from a person's own skin are similar to neural stem cells and are capable of producing Schwann cells (see Learning Objective 4 on how the nervous system works for details on these cell types) (Assinck et al., 2021; Miller & Kaplan, 2012; Miller & Gauthier, 2007; Sparling et al., 2015). This is promising because Schwann cells often create an environment in which injured nerve fibres can regenerate, something that normally does not occur after CNS damage (Jessen, Mirsky, & Lloyd, 2015). (Axons in the PNS, myelinated by Schwann cells, do regenerate under certain conditions, and Schwann cells are necessary for that regeneration to occur.) While this work is still in the experimental phase, it holds out the possibility that one day in the not too distant future we may be able to regrow damaged spinal cords and not have to rely solely on technology that is not part of the body for the treatment of spinal cord injuries.

THE CANADIAN PRESS/Jeff McIntos

Cutting Edge Treatment for Spinal Cord Injuries **In 2018, Ryan Straschnitzki of the Humbolt Broncos hockey team was injured in a bus crash and suffered spinal cord damage. Implantation of a spinal cord epidural stimulator has led to some recovery of leg function for Ryan.**

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

4. What are the two parts of the central nervous system?

5. What happens when the sympathetic nervous system is operating? How does that compare with the operation of the parasympathetic nervous system?

6. How do the brain and spinal cord work together?

7. What three neuron types are important for simple reflexes?

What Do You Think? • Describe an occasion when you have experienced the workings of the sympathetic nervous system. Have you ever been able to control your sympathetic or parasympathetic reactions? If so, how?

Structures of the Brain

LEARNING OBJECTIVE 3

List key structures of the brain and describe their relationships to our behaviour.

As mentioned in the chapter opener, the human brain weighs about 1400 grams (about 3 pounds). It is roughly the size of your two fists put together, uses approximately 20 percent of your body's energy, and makes up only 2 percent of your body's weight. Except for a few structures, the brain is almost entirely bilaterally symmetrical (i.e., the two sides appear the same). If it were laid flat, it would be too large, much too large, to fit in the skull. (Unfolded, the area of the cerebral cortex, the wrinkled outer layer of the brain, covers 2000 cm^2—roughly the size of a pillowcase.) To be compact enough to fit inside the skull, the brain had to fold upon itself as it developed, forming a number of convolutions or folds known as *gyri* (singular *gyrus*) or *sulci* (singular *sulcus*). To think about this, imagine for a minute that you are trying to put a piece of tissue into a small box. A 20 cm x 25 cm piece of tissue won't fit into a 5 cm square box. How do you solve this problem? Easy. You scrunch up the tissue and then it fits easily into the box. In this same way, greater brain surface can be accommodated without having to give up function and power. **Figure 3.3** shows the major structures of the brain. In this section, we will explore the major structures of the brain, from the bottom where the spinal cord connects with the brain, up to the topmost structure of the brain: the cortex.

The Hindbrain

The part of the brain closest to the spinal cord is called the **hindbrain**. The hindbrain consists of the medulla, the pons, and the cerebellum. The reticular formation, which runs up the centre of the medulla and pons, begins in the hindbrain and extends to the midbrain.

hindbrain the part of the brain closest to the spinal cord that consists of the medulla, the pons, and the cerebellum; the reticular formation begins here and extends to the midbrain.

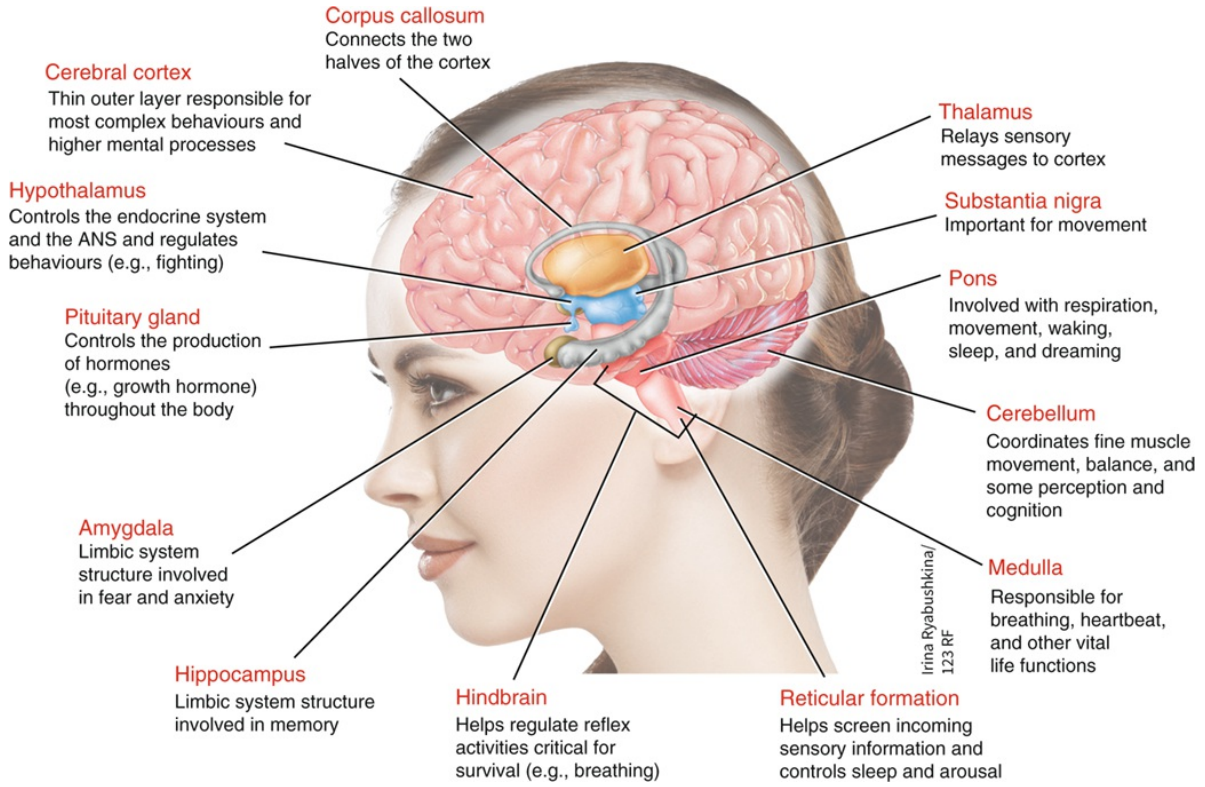


FIGURE 3.3 Major structures of the brain The brain is subdivided into many regions, which differ in structure and function. The parts of the brain that are shown in a colour other than pink are found deep inside the brain under the cerebral cortex.

The Medulla

The **medulla** extends up from the spinal cord and is important for basic bodily functions, including respiration and heart rate regulation, as well as for regulating reflexes such as sneezing and coughing. Although most of the actions of the brainstem occur without our conscious knowledge or control, this part of the brain is critical for survival and normal functioning. Damage to the medulla, as a result of stroke or trauma, is often fatal (Eggers et al., 2009) or associated with autonomic dysfunction in disorders such as Parkinson's (Pyatigorskaya et al., 2016). High levels of alcohol can also suppress medulla activity and cause heart or respiratory failure (Goodrich et al., 2016; Figueredo & Purushottam, 2013).

> **medulla** the part of the brain that controls basic bodily processes and regulates certain reflexes.

The Pons

Above the medulla is a region called the **pons**, named for the Latin word for "bridge." The pons acts as a bridge (hence its name) between the medulla and other brain areas (Goodrich et al., 2016). The pons is involved in sleep, dreaming, breathing, swallowing, eye movements, and facial sensation and expression. This part of the brain also contains the

locus coeruleus. Neurons of the locus coeruleus have long axons that project throughout the brain and spinal cord and are thus able to influence much of the CNS. These neurons use the neurotransmitter **norepinephrine** and are important for arousal and attention. It may be, for example, that under-functioning of the neurons in this area plays a role in attention deficit disorder (Hegerl & Hensch, 2014; Ito et al., 2017).

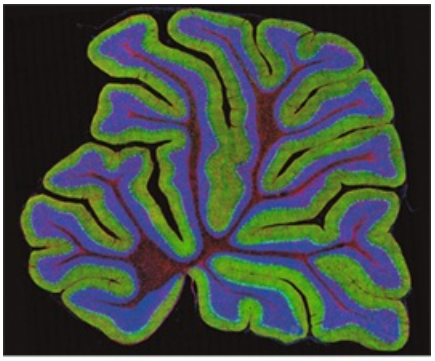
pons uppermost or anterior (front) part of the brainstem that includes the locus coeruleus.

norepinephrine a neurotransmitter that is important for arousal and attention.

The Cerebellum

Sitting at the back of the brain on top of, and connected to, the brainstem at the pons is the **cerebellum** (see image). This part of the brain is important for motor coordination. People with cerebellar damage often have an awkward gait and have difficulty reaching for objects without trembling (Goodrich et al., 2016). In addition to its role in motor coordination, the cerebellum is important for certain types of learning involving movement. For example, when you learn to tie your shoelaces or to play the piano, your cerebellum is at work. Also, if you are asked to participate in a field sobriety test to see if you are impaired, you could be asked to walk heel to toe along a line or close your eyes and touch your nose with your finger (Del Brutto et al., 2016; Green et al., 2010). Both of these tasks require the sort of smooth movements that the cerebellum makes possible (unless you are drunk!). Other parts of the brain participate in controlling motor behaviours as well, particularly in cases where the task involves paying attention to a complicated series of instructions (for example, when learning how to execute a gymnastics move where you have to learn to backward jump with a quarter turn and a side flip). Once it's completely learned, the cerebellum then stores the learned motor information, ready to be recalled automatically when needed (Stoodley & Schmahmann, 2016).

cerebellum the part of the brain, near the base of the back of the head, important for motor coordination.



Courtesy Thomas Deerinck, NCMIR,
University of California, San Diego

A convoluted brain region The cerebellum is a highly folded structure, as shown here in this fluorescent image of a slice through this part of the brain.

The Reticular Formation

A complex network of nuclei (clusters of neurons that work together) extends from the hindbrain to the midbrain and together form an area known as the **reticular formation**. The reticular formation regulates the sleep-wake cycle and plays a role in wakefulness as well as level of arousal. Many general anesthetics work by reducing activity in the reticular formation and thus rendering the patient unconscious (Duggan & Schwock, 2017; Melzack & Wall, 2016). Some nuclei control other types of functioning, including attention, movement, maintaining muscle tone, and cardiac, circulatory, and respiratory functions (Breedlove & Watson, 2020). Several groups of neurons in the reticular formation, called the dorsal raphe, are critical for controlling mood and likely play a role in depression (Reinoso-Suárez et al., 2017).

reticular formation a complex neural network extending from the hindbrain into the midbrain that plays a central role in regulating consciousness and arousal.

The Midbrain

Above the pons sits the *midbrain*. The midbrain, which is relatively small in humans, contains a number of different nuclei, among them the *substantia nigra*. Like the cerebellum, the substantia nigra is important for movement, but this area serves different movement-related functions from those of the cerebellum. Like neurons in some other regions of the brain, neurons in the substantia nigra produce the neurotransmitter **dopamine**. These particular dopamine neurons communicate with other brain regions located in the forebrain; the neurons in this pathway are critical for fluidity of movement, such as walking with a steady rhythm, as well as inhibition of movement (see Positive Psychology 3.1). The **substantia nigra** is the major structure damaged in *Parkinson's disease* (Ilango et al., 2014; Meyer et al., 2010), a neurological disorder characterized by progressive degeneration of dopamine-containing cells. (You will be introduced to neurotransmitters like dopamine later in this chapter.) Cell loss in this structure is slow and occurs over a period of time, but the symptoms only appear after extensive cell death has taken place (Coelho & Ferreira, 2012).

dopamine neurotransmitter produced by neurons in the hind brain and involved in movement and reward mechanisms.

substantia nigra a brain region important in fluidity of movement and inhibiting movements.

3.1 Psychology Around Us | Positive Psychology

Music on the Brain

Brain damage and degeneration can lead to long-term impairments in all domains of function, including physical, emotional, social, and mental health. It can not only have long-term health effects for the person who has undergone the injury, but it can also have a significant negative impact on the family and friends of the brain-injured

person. New research is showing, however, that music therapy can be used to improve all the domains affected by brain injury (Hegde, 2014). Agitation, which is common in patients after a traumatic brain injury, is often reduced when patients are given the opportunity to listen to their preferred music style (Park, Williams, & Lee, 2016).

While listening to music may be beneficial, it is the actual practice of learning to make music that likely has the most benefit with regards to long-term recovery. For example, learning to match a rhythm on a drum to a preset beat can improve motor function as well as support cognitive and language rehabilitation (Thaut, McIntosh, & Hoemberg, 2015). In a recent neuroimaging study, it was found that a neurological music therapy intervention led to an increase in grey matter in the prefrontal cortex (Siponkoski et al., 2020). Finally, Jessica Grahn, an associate professor at Western University in Ontario, has been studying the effects of music on people with Parkinson's disease. She has shown that music can activate neural networks in motor areas of the brain to help support movement in people after stroke or with Parkinson's disease (Nombela, Hughes, Owen, & Grahn, 2013; Patterson, Wong, Knorr, & Grahn, 2018). These data indicate that music therapy, both listening to music and making it, may provide a unique behavioural intervention to support brain plasticity, improve recovery after injury, and support motor function in individuals with progressive diseases like Parkinson's disease (Siponkoski et al., 2020).

Source: Pexels/Pixabay

Music therapy for brain repair **Drumming is a great way to activate the brain after injury and can support motor, cognitive and language recovery.**

The Forebrain

The largest subdivision of the human brain is the forebrain, which controls complex cognitive, emotional, sensory, and motor functions. The forebrain is divided into two cerebral hemispheres connected by a band of white matter called the *corpus callosum*

(which is described in more detail later in this chapter). Each side of the brain controls the opposite (*contralateral*) side of the body. The outermost layer of each hemisphere is composed of grey matter (largely neuron and glial cell bodies; see next section) called the *cerebral cortex*. Beneath the cortex are the subcortical (below the cortex) structures. The subcortical structures lie buried inside the forebrain and include the thalamus, hypothalamus, pituitary gland, limbic system, and basal ganglia.

The Thalamus

The **thalamus** is a large collection of nuclei located anterior to, or in front of, the substantia nigra. It sits in the centre of the brain between the midbrain and higher areas of the forebrain, or cortex. Some of the thalamic nuclei serve as relay stations for incoming sensory information. In fact, all of our sensory systems, with the exception of the sense of smell, have a major pathway that connects the sensory system to the cortex via the thalamus (Rolls, 2015). Two structures of note in the thalamus are the *lateral geniculate nucleus* (LGN) and the *medial geniculate nucleus* (MGN). The LGN is important for relaying visual information to the visual area of the cortex, and the MGN is important for relaying auditory information to the auditory area of the cortex (Carlson & Birkett, 2017).

> **thalamus** an area of the brain that serves, in part, as a relay station for incoming sensory information.

The Hypothalamus

The **hypothalamus** is aptly named because this collection of nuclei sits beneath the thalamus (the prefix *hypo* comes from ancient Greek for below or under). Regions of the hypothalamus are important for a number of motivated behaviours necessary for our survival as a species, including eating, drinking, sex, sleep, and maternal behaviour. Damage to discrete parts of the hypothalamus can dramatically alter these basic behaviours. The hypothalamus is also critical for the control of the **endocrine**, or hormonal, **system** (Saper, 2010).

> **hypothalamus** brain structure important for motivation and control of the endocrine system.
>
> **endocrine system** the system that controls levels of hormones throughout the body.

The Pituitary Gland

The hypothalamus is connected to the **pituitary gland**, a small structure found directly under the hypothalamus. The pituitary works with the hypothalamus to control a particular class of chemical messengers in the body—*hormones*—that are important for growth, reproduction, metabolism, and stress reactions. The pituitary produces releasing factors that control endocrine glands, such as the ovaries, the testes, the thyroid, and the adrenal glands.

> **pituitary gland** brain structure that plays a central role in controlling the endocrine

system.

The Limbic System

The hippocampus, the amygdala, the hypothalamus, parts of the thalamus, and several other brain structures are collectively referred to as the **limbic system** due to the interconnectivity, and influence on one another, of these structures. While its anatomical boundaries are somewhat unclear, the limbic system structures are involved in the regulation of motivation, emotion, and learning and memory (Ashy et al., 2017; Causadias, Telzer, & Lee, 2017). Its name means "edge" in Latin, which refers to the way that the limbic system connects many other brain areas (MacLean, 1954). There is some debate about whether the limbic system designation should be abandoned and whether it is still useful, as many researchers believe that the individual cortical and subcortical nuclei and structures cannot really be described as a "system" (Carlson & Birkett, 2017).

limbic system a group of interconnected brain structures that are associated with learning, memory, basic emotions, and drives.

The **amygdala** is located deep within the brain, in a region referred to as the temporal lobe (see photo). Like the thalamus and hypothalamus, the amygdala is not a homogeneous structure. Instead, it is a collection of nuclei that serve different functions. The amygdala is involved in recognizing, learning about, and responding to stimuli that induce fear (Gouty-Colomer et al., 2016; Méndez-Bértolo et al., 2016; LeDoux, 2017). This brain region has been the focus of considerable attention by neuroscientists because it is involved in the development of phobias, or abnormal fears (Homan & Schiller, 2016; Rigoli et al., 2016). In addition, the amygdala has been implicated in processing information related to more positive emotions (Bonnet et al., 2015).

amygdala brain area involved in processing information about emotions, particularly fear.

The amygdala communicates with the **hippocampus**, a brain region important for certain types of learning and memory. Neuroscientists have extensively studied individuals with damage to the hippocampus and found that they are incapable of forming new *episodic* memories, or memories about events (Bindschaedler et al., 2011). Research suggests that the hippocampus only temporarily stores information about events, after which the memories are stored elsewhere (Ricker, 2015). In addition to its role in the formation and transient storage of episodic memories, the hippocampus is important for learning about one's spatial environment. Learning how to navigate around a new campus, for instance, requires the hippocampus.

hippocampus brain region important for certain types of learning and memory.

vuk8691/Getty Images

The amygdala in action **The amygdala processes the stimuli that elicit fear, such as displayed by this novice skydiver during a tandem flight.**

The hippocampus has been extensively studied as a region of neuroplasticity. In fact, it is a region known to produce entirely new neurons in adulthood (Akers et al., 2014; Song et al., 2016). The function of these new neurons remains unclear, but their presence suggests that the adult brain is capable of regenerative processes, leading to the hope that the production of new neurons, or *neurogenesis*, may be harnessed for brain repair.

The Basal Ganglia

The basal ganglia are a group of nuclei that work as a cohesive functional unit and include the caudate nucleus and the putamen, globus pallidus, substantia nigra, and nucleus accumbens. The majority of these structures sit in the middle of your brain just below the cerebral cortex. These nuclei are strongly interconnected with many brain areas, including the cerebral cortex, thalamus, and hindbrain structures. As a group, the basal ganglia are believed to play a role in cognitive flexibility (Stocco, Lebiere, & Anderson, 2010; Vatansever et al., 2016) and in regulating and coordinating voluntary movement control. For example, if you play an instrument, video game, or any sport, you may have noticed that you do better at it when you don't think about the movements required to complete the task: that is your basal ganglia at work. (Chakravarthy, Joseph, & Bapi, 2010; Mink, 2018). One area of the basal ganglia, the **nucleus accumbens**, is important for motivation and reward learning (Nemmi et al., 2016). It receives important projections from neurons in the midbrain that use dopamine as a neurotransmitter. Dopamine release in the nucleus accumbens has been associated with reward learning and has been implicated in drug abuse (Salgado & Kaplitt, 2015).

nucleus accumbens a brain area important for motivation and reward.

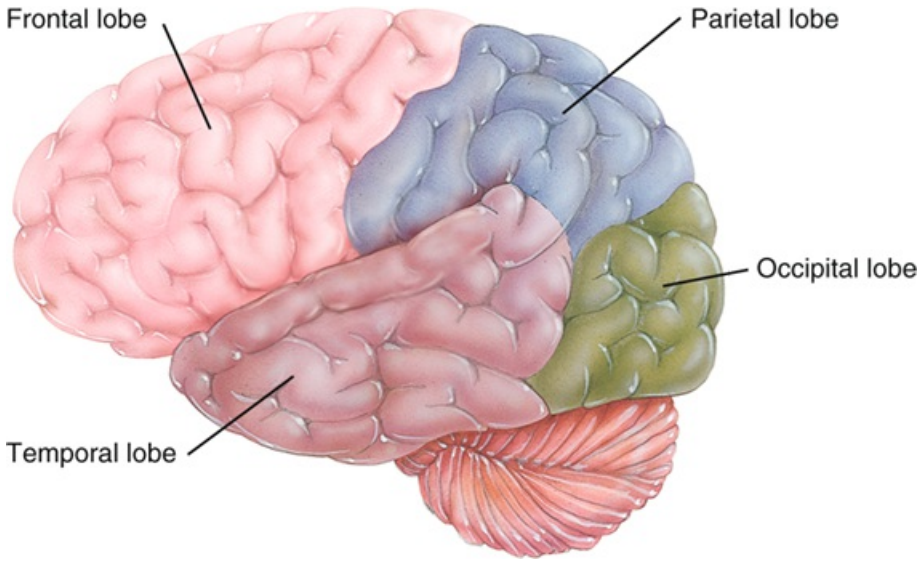


FIGURE 3.4 The lobes of the cortex The cortex can be subdivided into four lobes: frontal, parietal, occipital, and temporal.

Cerebral Cortex

The **cerebral cortex**, the folded outer covering of the cerebral hemispheres, is highly developed in humans and is responsible for many of our most complex functions, including consciousness, language, and thought (Willimzig, Ragert, & Dinse, 2012). The cerebral cortex is said to be the only structure that can think about itself. Although some of the functions of specific cortical regions are not well understood, there is consensus among neuroscientists that, within the cortex, there is localization of function. This means that specific parts of the cortex are important for specific behaviours or abilities (Breedlove & Watson, 2020).

> **cerebral cortex** the largest portion of the brain, responsible for complex behaviours including language and thought.

Based on functional and anatomical differences, neuroscientists have subdivided the cortex into four major cortical regions or *lobes*, as shown in **Figure 3.4**: occipital, temporal, parietal, and frontal. Each of the lobes has distinct functions. However, in undamaged brains, the four lobes are in constant communication and thereby perform many high-level functions collaboratively (see photo). The cerebral cortex can also be subdivided according to function into two broad categories:

Primary sensory and/or motor areas. These areas are responsible for processing basic sensory information as well as directions for voluntary movement. As we will see, the primary sensory and motor parts of the cortex process information related to the opposite, or *contralateral*, side of the body.

Association cortex. **Association cortex** is responsible for many complex functions, including higher-order sensory processing, integrating information from different senses (how you know that an object that looks like a violin is producing the music you

hear), thinking, planning, and other complex functions, such as knowing you are you and not someone else.

> **association cortex** areas of the cortex responsible for complex functions, including higher-order sensory processing, thinking, and planning—all of cortex that is neither purely sensory nor motor.

The Occipital Lobe

The **occipital lobe**, at the back of the cerebral cortex, contains the *primary visual cortex*, an area important for processing information about visual stimuli. Visual information is processed contralaterally. That is, information received from each side of the visual world (each visual field) is passed to the opposite side of the brain. As a result, your right primary visual cortex processes information from the left visual field and vice versa (Bear, Connors, & Paradiso, 2020). Information about colour, complex patterns, and motion is communicated along separate subcortical pathways from the eyes, and is not integrated until it reaches visual cortex (Murray et al., 2016; Collignon et al., 2011).

> **occipital lobe** lobe of the cortex at the back of the skull, important for processing very visual information.

The occipital lobe is very well developed in humans. However, it is important to realize that visual information is also processed in other parts of the brain. In fact, some estimates suggest that 50 percent of the human brain is devoted to some sort of vision-related task (Gregory, 2015)! Connections to other parts of the cortex (association cortex in the temporal and parietal lobes) enable us to link visual information to information from other sensory modalities, as well as to our memory stores. This *cross-modal* integration allows us, for example, to hear a bird's song and imagine a visual image of the bird.

The Temporal Lobe

The **temporal lobe** is located on the side of the brain and wraps around the hippocampus and amygdala. The temporal lobe includes areas important for processing information about auditory stimuli and language. The *primary auditory cortex* in the temporal lobe processes sound frequency (Leaver & Rauschecker, 2016; Zündorf, Lewald, & Karnath, 2016), and other areas in the temporal lobe create meaning from the sound. Some people who have epileptic seizures centred in this region report "hearing" very loud music during seizures (Engmann & Reuter, 2009). Neurosurgery to remove neurons that appear to be generating seizures is particularly dangerous in the temporal lobe since there are so many critical functions (e.g., language and memory) that may be disrupted during the removal of neighbouring neurons (Hrazdil, et al., 2013; Kaido et al., 2010). (See Your Brain and Behaviour 3.1.)

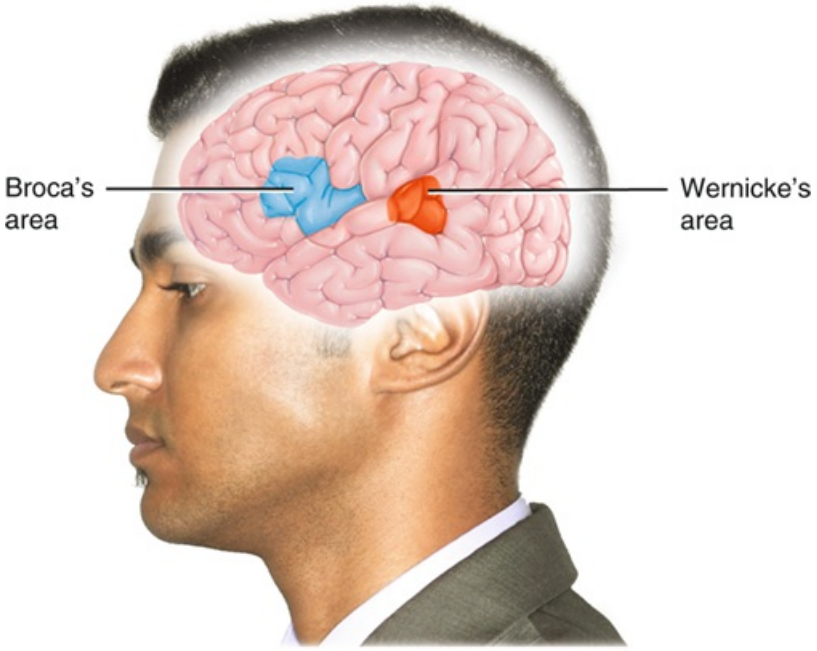
> **temporal lobe** part of the cortex important in processing sound, in speech comprehension, and in recognizing complex visual stimuli, such as faces.

Chad Slattery/The Image Bank/Getty Images

Parallel processing **Air traffic controllers must react to an array of sensory stimuli and make quick decisions. Communication within and between the lobes of the brain allows us to perform such complex functions simultaneously.**

The temporal lobe also contains regions important for language comprehension (Ardila, Bernal, & Rosselli, 2016). Shown in **Figure 3.5**, **Wernicke's area** is located on the left side of the brain in the vast majority of humans (over 90 percent). (Finding Wernicke's area in the left hemisphere of the brain is a good example of a phenomenon called *lateralization of function*, which means that a particular ability is localized to one side of the brain.) Wernicke's area communicates with other cortical areas, including a region important for the recognition of appropriate syntax (language rules), and a language area important for the production of speech, called *Broca's area*, located in the frontal lobe.

Wernicke's area an area of the temporal cortex important in helping us understand language.



Asia Images Group/ Getty Images

FIGURE 3.5 Major brain regions important for speech production and language comprehension Broca's area, located in the frontal lobe, is critical for speaking; Wernicke's area, located in the temporal lobe, is critical for understanding language.

In addition to the temporal lobe involvement in hearing and language comprehension, this lobe also plays important roles in learning and memory as well as in recognition of objects via visual cues. Regions of the temporal cortex respond to complex visual stimuli, such as faces (Grill-Spector & Weiner, 2014). Neuroimaging studies have shown that parts of this brain region are activated when people view photos of faces, particularly familiar faces. These findings are strengthened by the fact that recording electrodes placed into these same brain regions show changes in neuronal activity, or firing rate, when the same complex visual stimuli are presented (Fridriksson, Fillmore, Guo & Rorden, 2015; Harris, Young, & Andrews, 2014).

The Parietal Lobe

The **parietal lobe**, located on the top middle region of the brain, contains the primary sensory area responsible for the somatosensory system. This region is known as the **somatosensory strip** and is a band of cortex that processes tactile (e.g., touch, pressure, vibration, and pain) information from different body parts. As **Figure 3.6** shows, this area of the brain is organized in sections that receive information from specific parts of the body but some parts of the body are represented to a greater degree than others. For instance, somatosensory information about the lips (which are particularly sensitive) is processed by a greater amount of cortex than is somatosensory information about the elbow. Also, remember that the somatosensory cortex (and motor cortex, which we will discuss shortly) in each hemisphere communicates with the opposite side of the body.

parietal lobe lobe of the cortex involved in processing information related to touch and complex visual information, particularly about locations.

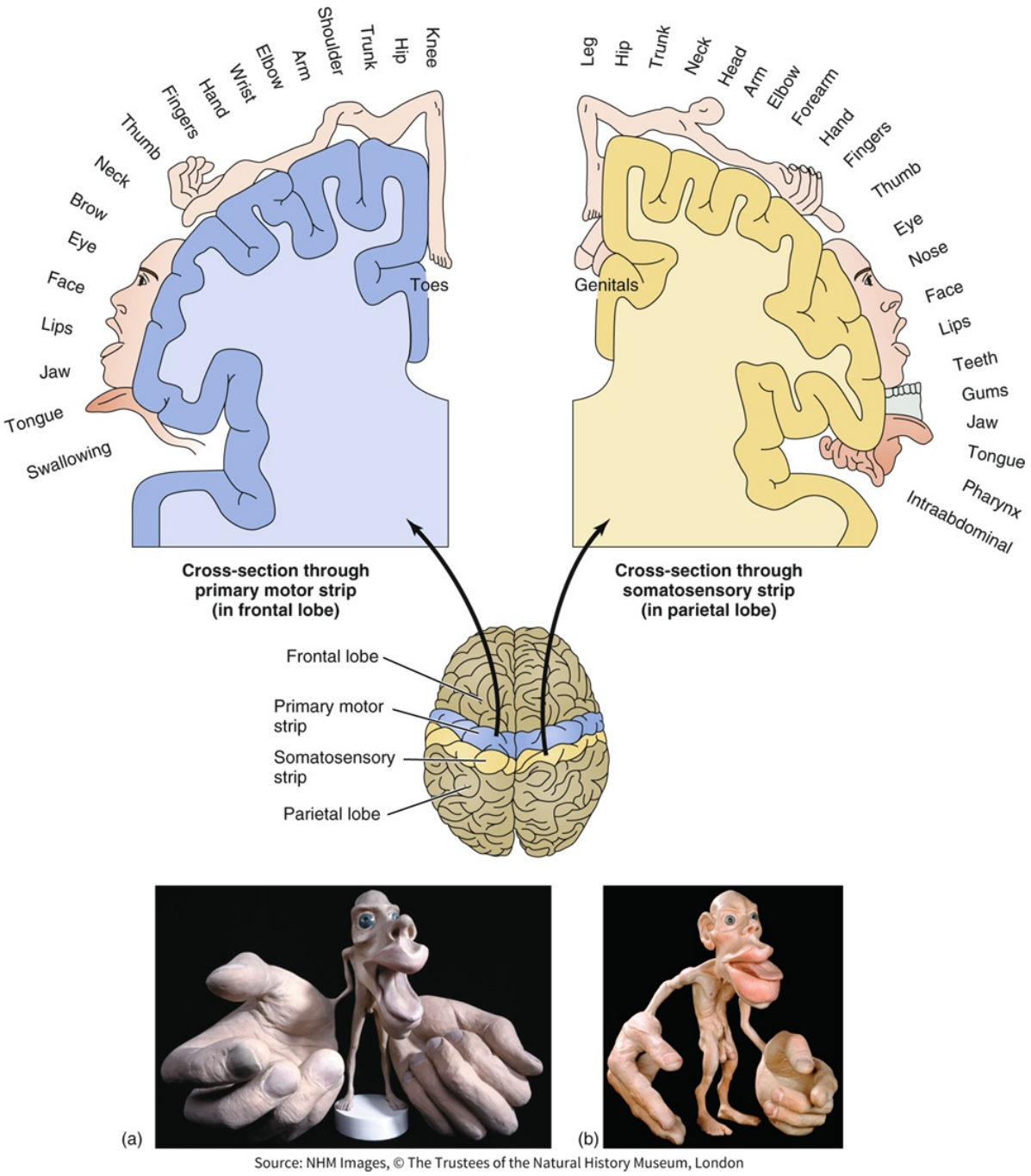
somatosensory strip an area of the parietal cortex that processes tactile information coming from our body parts.

In addition, the parietal lobe plays an important role in the higher-order processing of visual stimuli. As we will see in Chapter 5 on sensation and perception, processing visual stimuli involves localizing visual cues in space. The parietal lobe is included in a system known as the "where pathway" that enables us to see and respond to visual information in a spatially appropriate way. People with damage to the "where pathway" can find it impossible to pour water from a pitcher into a glass. This deficiency is not due to a motor disturbance, but rather to an inability to properly determine where the glass is located relative to the pitcher.

The Frontal Lobe

Located at the front of the brain (behind the forehead) is the **frontal lobe**. The frontal lobe is a relatively large cortical region and is proportionately larger in humans compared to less complex animals. Like the other cortical lobes, the frontal lobe is not just one homogeneous area, but a large collection of regions that serve numerous functions. Broadly speaking, the frontal lobe is important for temporal planning, understanding social relationships, and movement. The *primary motor strip*, shown in **Figure 3.6**, is involved in the control of voluntary (non-reflexive) movement. For a long time it has been known that stimulation of different parts of the primary motor strip invokes movement in specific groups of muscles (Fulton, 1938). Recent research suggests that parts of motor cortex also coordinate the use of these muscles in complex movements (Graziano, 2016). (See Positive Psychology 3.2.)

frontal lobe lobe of the cortex involved in many functions, including movement and speech production.



Source: NHM Images, © The Trustees of the Natural History Museum, London

FIGURE 3.6 Motor and sensory cortices organized according to body parts Adjacent neurons in motor cortex send information to adjacent muscle groups, and adjacent neurons in somatosensory cortex receive tactile information from adjacent skin regions; thus activity in these cortical regions can be said to form maps representing the skin and body musculature. Some regions are overrepresented, including the mouth and hands. (a) A motor *homunculus*, and (b) a sensory *homunculus*. Homunculus is Latin for "little man."

In addition to its role in controlling movement, the left (in most people) frontal lobe contains a region called **Broca's area**, which is critical for speech production and for

providing grammatical structure to language. Individuals with damage to this region, or to the connections between Wernicke's and Broca's areas, suffer speech impairment despite having normal language comprehension (Fridriksson et al., 2015).

> **Broca's area** a brain region located in the frontal lobe important for speech production.

The part of the frontal lobe closest to the front of the head is referred to as the **prefrontal lobe** and is important for a large number of functions including short-term memory or working memory (Soto et al., 2008). When you look up a phone number and "hold" that number in your mind while you dial, you are using your prefrontal cortex. In addition, when you execute complex plans, such as figuring out how to fit in studying around your work schedule, or determining which bus route to take to get to a friend's house, you are using your prefrontal cortex.

> **prefrontal lobe** portion of the frontal cortex involved in higher-order thinking, such as memory, moral reasoning, and planning.

Moral reasoning, and our understanding of social relationships, has also been localized, at least in part, to an area in the prefrontal cortex, which is the most anterior area of the frontal lobes (Decety & Cowell, 2014). People with damage to the prefrontal cortex can have difficulty understanding ethical principles despite having a normal IQ (Eslinger & Robinson-Long, 2016). The prefrontal cortex has also been implicated in some aspects of mood regulation (Bendall, Eachus, & Thompson, 2016).

One of the earliest documented examples of localization of function involved an individual with damage to the prefrontal cortex. In 1848, a 25-year-old construction foreman named Phineas Gage was tamping blasting powder into a hole in a rock while helping to build a railroad in Vermont. Unbeknownst to him, there was flint in the rock and the flint generated a spark when struck by the tamping rod, causing the charge to explode prematurely. As shown in **Figure 3.7**, the force of the explosion drove the rod (3 cm thick and 90 cm long) through Gage's left cheek and out the top of his head, passing through the prefrontal lobes of his brain (Damasio et al., 1994). Almost immediately following the accident, Gage was able to talk and walk back to the wagon with the help of his men. He miraculously recovered physically, but those who knew him before the accident reported that his personality had changed. Once a responsible, likeable, mild-mannered individual, Gage became irreverent, impatient, and impulsive, and was so unreliable that he lost his job and was never able to hold a responsible position again (Harlow, 1848; Macmillan, 2008).

3.2 Psychology Around Us | Positive Psychology

Neural Machine Interfacing—New Hope for Amputees

Source: canadabrian/Alamy Stock Photo

Artificial hand **Kevin Englehart, a researcher at the University of New Brunswick's Institute of Biomedical Engineering, works on an artificial hand.**

With more sophisticated knowledge of brain structure and function, neuroscientists are developing new methods for treating loss of function resulting from long-term paralysis or amputation. Kevin Englehart, at the University of New Brunswick's Institute of Biomedical Engineering, has been working with a team funded by a U.S. defence agency to develop a neural machine interface to control upper limb prostheses so that amputees can regain mobility and motor function. In addition to regaining motor function amputees with functional prosthetics also regain a sense of worth, feel less frustration, and a sense of difference from the people around them. This in turn can lead to greater comfort in social situations and increased feelings of self-worth. Nerves are redirected to reinnervate muscles (a process to restore nerve supply to a place from which it was lost) and electronics are embedded into the body so that the prosthetic limb can reliably receive and encode signals from the muscles (Scheme et al., 2014; Zhou et al., 2007). Although the bionic arm project drew to a close in 2009, Dr. Englehart has redirected his research to focus on a bionic hand that can be controlled by thought. In similar research, scientists at the University of Pittsburgh are testing brain implants that they hope will enable paralyzed patients to move prosthetic arms with their thoughts (Kamavuako, Scheme, & Englehart, 2016; Radmand, Scheme, & Englehart, 2016; Collinger et al., 2012). Electrodes implanted in the motor cortex will interpret patients' brain signals and send signals about hand orientation and reaching to a computer, which will in turn control the precise and specific movements of a prosthetic arm and hand, thereby allowing individuals to recover their independence.

From H. Damasio, T. Grabowski, R. Frank, A.M. Galaburda, A.R. Damasio (1994). The return of Phineas Gage: Clues about the brain from a famous patient. *Science*, 264:1102–1105. Dornsife Neuroscience Imaging Center and Brain and Creativity Institute, University of Southern California.

FIGURE 3.7 After the accident This reconstruction shows how the spike likely entered Gage's head, damaging the prefrontal cortex.

Gage's accident and the consequences of the accident were of particular importance because, at the time, physiologists were debating whether specific parts of cortex carried out different functions (see photos). The case of Phineas Gage provided clear support for the localization of function hypothesis.

Additional data supporting localization of function was collected in the 1930s when two neuroscientists, Klüver and Bucy (1939), discovered that bilateral removal of the temporal lobes in monkeys led to significant reductions in aggression and fear. The animals displayed difficulties with visual recognition, as well as a tendency to fixate on oral stimulation and a marked increased interest in sex. Following discoveries that brain lesions alter emotional responding, clinicians began to devise surgical means of treating serious behavioural disorders in people. A procedure called a prefrontal lobotomy was used in the 1940s and 1950s to treat thousands of individuals with problems ranging from severe mental illness to non-conformity and rebellion (Heller et al., 2006). Although reports indicated that such surgery had a calming effect on chimpanzees (Jacobson, Wolf, & Jackson, 1935), in humans it was associated with apathy, blunted emotional responding, changes in personality, irresponsibility, and seizures. Today, more limited destruction of the prefrontal cortex is used for a small number of patients suffering from severe depression or other forms of mental illness who do not respond to drug therapy (Szczepanski & Knight, 2014; Riestra et al., 2011).

Source: AP Images/JEFF THOMPSON/EAU CLAIRE LEADER

Brain injury and nail guns **Although nail gun accidents can and do occur, they rarely cause brain injury as the nail generally fails to penetrate the skull. However, in 1998, construction worker Travis Bogumill was accidentally shot with a nail gun near the rear of his right frontal lobe. Bogumill experienced only an impaired ability to perform complex mathematical problems, consistent with experimental research showing that the frontal lobes are responsible for mathematical calculations.**

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

8. Which part of the brain is essential to basic functioning, such as breathing?

9. Describe the role of the brain in regulating hormones throughout the body.

10. Which part of the brain has been linked with our fear responses?

11. What function is most closely linked to the hippocampus?

12. Which of our senses is linked primarily with the occipital cortex? With the temporal cortex? With the parietal cortex?

13. What are the primary functions of Broca's and Wernicke's areas, and where are they located?

14. What mental functions are associated with the frontal cortex?

15. What structure is important in allowing the two hemispheres of the brain to communicate?

What Do You Think? • What are the potential pitfalls in making inferences about brain function from studying a single brain area?

How Does the Nervous System Work?

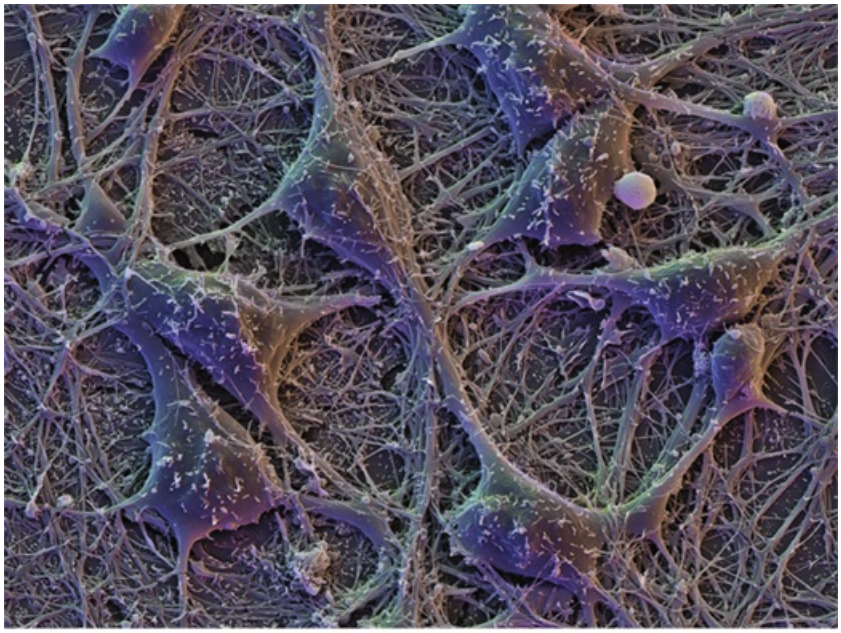
LEARNING OBJECTIVE 4

Describe the two major types of cells in the nervous system and describe the primary functions of each.

The neuron, or nerve cell, is the fundamental building block of the nervous system. Communication among neurons is necessary for normal functioning of the brain and spinal cord (see photo). The peripheral nervous system that runs throughout the rest of our bodies, outside the brain and spinal cord, is also made up of neurons.

The structure and function of individual neurons, as well as the ways in which these cells work together in groups (called *neural networks*), have been the subject of considerable scientific inquiry for over a century (Carlson & Birkett, 2017). Neuroscientists have discovered that neurons have specialized structures that enable them to communicate with other neurons using both electrical and chemical signals. As we will see later, in this chapter and throughout this textbook, our emerging understanding of how these signals work is leading toward the development of treatments for adjusting our neurochemistry when things go wrong.

But neurons are not the only cells in the nervous system. Neuroscientists have increased their research into understanding the role of *glial* cells, the other type of cell found in our nervous systems.



David Scharf/Science Source

Neurons Human cortical neurons (brain cells), showing an extensive network of interconnecting dendrites between the large triangular-shaped cell bodies.

Neurons and Glia

The basic structure of a neuron is shown in **Figure 3.8**. Like most of the other cells that make up who we are, the neurons have a cell body filled with cytoplasm that contains a nucleus (the residence of chromosomes that contain the genetic material). In addition, neurons contain organelles that enable the neuron to make proteins and other molecules, produce energy, and permit the breakdown and elimination of toxic substances. Just as our own organs make it possible for our bodies to live and function, organelles make it possible for our neurons to live and function (Britt et al., 2016).

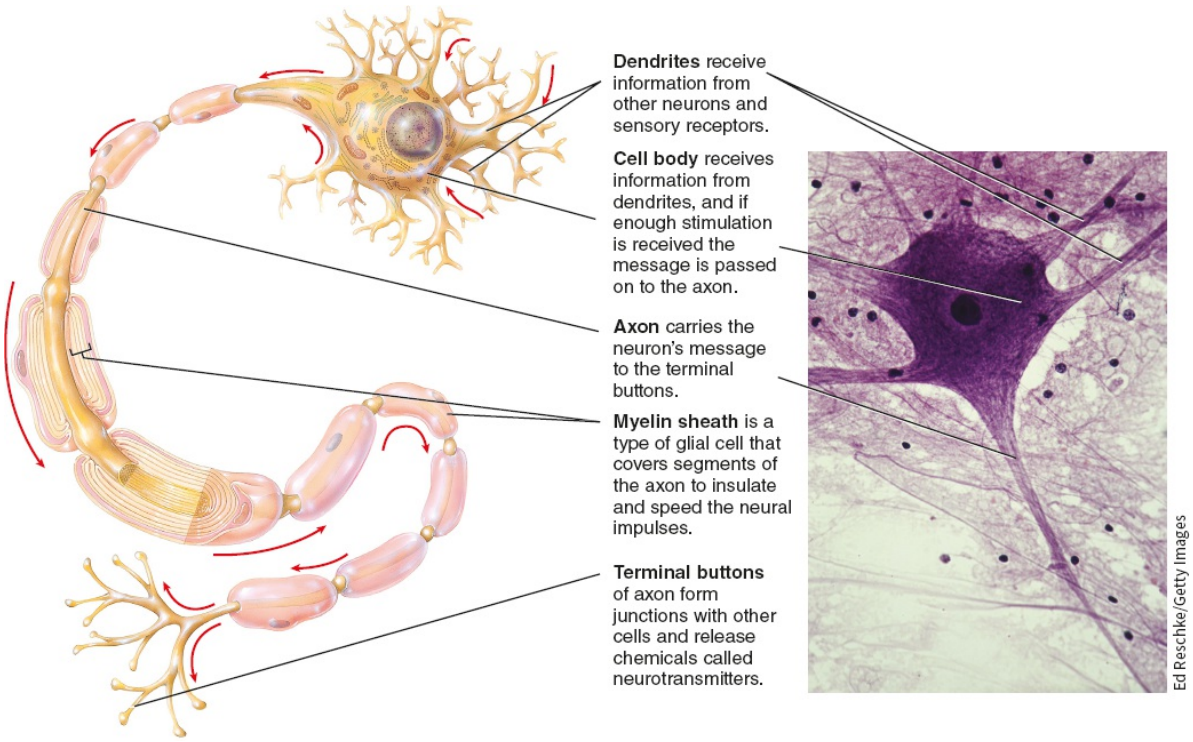


FIGURE 3.8 The neuron The major structures of the neuron include the cell body, the axon, and the dendrites. Dendrites typically receive information from other neurons, while axons send information away from the cell body to communicate with other neurons. Arrows indicate the direction of information flow. Reprinted with permission of John Wiley & Sons, Inc., from Tortora, G., & Derrickson, B. H. (2009). *Principles of Anatomy and Physiology* (12e). Hoboken, NJ: Wiley, Figure 12.2, p. 418.

However, as Figure 3.8 shows, neurons have a different shape than the round shape many people think of when picturing a cell in their mind. They have specialized structures called *dendrites* and *axons* that are important for communication with other neurons.

Dendrites extend like branches from the cell body to receive inputs from other neurons. Neurons can have many dendrites and, indeed, some have very extensive dendritic "trees." These trees receive signals from the ends of axons on other neurons and a single cortical neuron may received upward of 200,000 inputs, or signals from other neurons in the brain.

dendrites the parts of neurons that receive input from other neurons.

An **axon** also extends from the cell body. Unlike dendrites, however, axons function to carry signals away from the cell body. Axons have a specialized region at the end, called the **axon terminal**, where the signal from the cell body, which flows down the axon, is passed on to the dendrites of the neurons the axon communicates with. At the end of each axon are many specialized structures (synapses) where information is passed from one neuron to another across a very small fluid-filled space. When an electrical impulse (an *action potential*) reaches the axon terminal, it causes fluid-filled sacs called *vesicles* (filled with chemicals called *neurotransmitters*) to migrate to, and fuse with, the neuronal membrane

and to then release neurotransmitters into the synapse. We will discuss this process in greater detail shortly. Unlike dendrites, neurons have only one axon leaving the cell body. Axons, however, can be highly branched; these branches, or *collaterals*, greatly increase the number of neurons that the axon contacts. Axons can also be very long. For example, if you stub your toe, the axon that carries pain information from your toe runs from the end of your toe all the way to the bottom of your spinal cord. In addition, some axons (but not all) are covered with a fatty covering called a *myelin sheath* (which we describe in greater detail later in the chapter).

axon the part of the neuron that carries information away from the cell body toward other neurons.

axon terminal the end of a neuron's axon, from which neurotransmitters are released.

There are many different kinds of neurons. For example, there are sensory neurons with specialized sensory endings in the skin that respond to pressure, temperature, and pain, motor neurons in the muscles or ligaments that respond to changes in muscle length or tension and stimulate our many muscle cells into action; and interneurons that communicate with both sensory and motor neurons and with other interneurons. Some neurons are large, such as the primary sensory neurons, whose axons run from your feet to your spinal cord and can be as long as 1.5 metres, while others are very small, such as many of the neurons found in the brain (Figure 3.9). Some neurons in our nervous systems have very elaborate dendritic trees, while others possess only a single unbranched dendrite (Hogan, 2010). Although these cells all look quite different from one another, they all have an axon and dendrites and are covered by a semi-permeable cell membrane. The structure of this membrane is critical as it makes it possible for neurons to communicate with other cells by means of chemical and electrical signals (Carlson & Birkett, 2017).

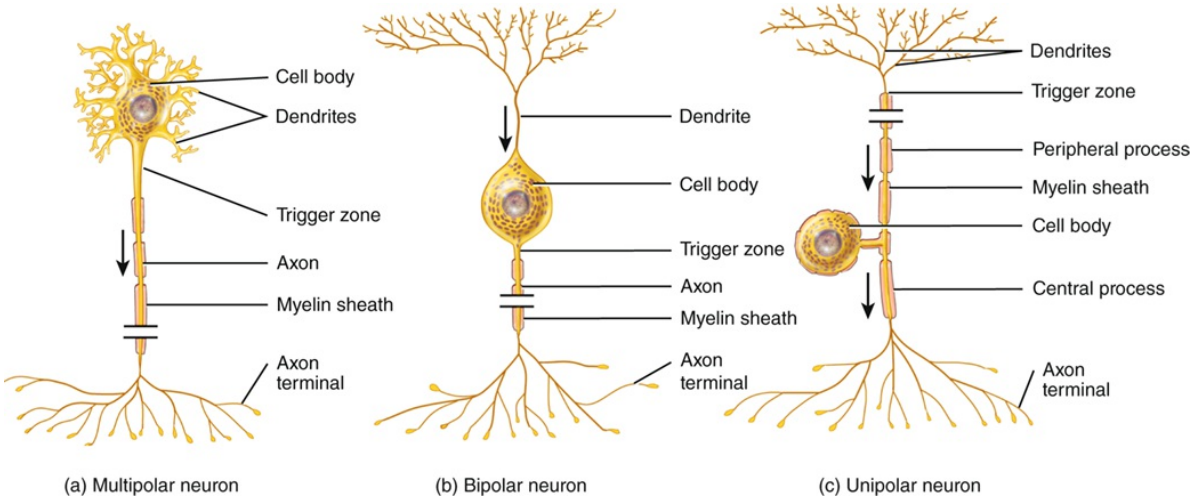


FIGURE 3.9 Various shapes These examples illustrate the diversity in the shape of neurons.

Source: Reprinted with permission of John Wiley & Sons, Inc., from Tortora, G., & Nielsen, M. (2014). *Principles of Human Anatomy*, 13th edition. Hoboken, NJ: Wiley, p. 550.

In addition to neurons, the nervous system contains a large number of non-neuronal cells called neuroglial cells, or **glia** (or *glial cells*). Although there is a great deal of debate about the number of glia in the human brain, it is generally accepted that there are about the same number of glial cells as there are neurons (von Bartheld, Bahney, & Herculano-Houzel, 2016). However, in some parts of the human brain, such as the cerebral cortex, some researchers contend that glia may outnumber neurons by a factor of about 3 or 4 to 1 (Herculano-Houzel, 2014; Laming et al., 2011).

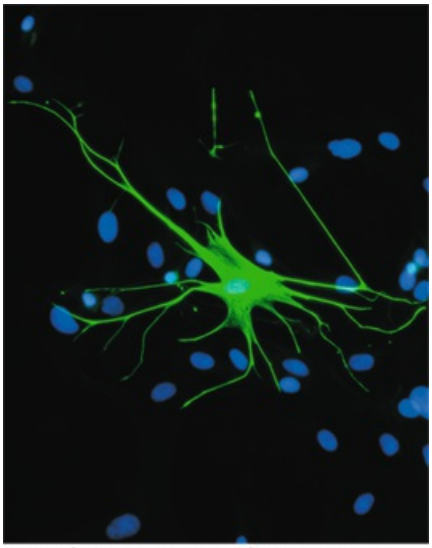
glia the cells that, in addition to neurons, make up the nervous system.

More Than Just Glue

In 1856, German biologist Rudolf Virchow identified cells in the brain that he identified as a type of "structural filler." He gave these cells a Greek name that means "glue" because he believed their chief function was to form a physical medium to hold the brain together (Somjen, 1988). Now, more than 160 years later, we know that glia play a much more complex role in the brain and that they are critical for normal functioning (Han et al., 2012; Fraser et al., 2011; Laming et al., 2011). Glial cells are involved in every facet of neuron function (Jäkel & Dimou, 2017). For example, they create a barrier between the central nervous system and circulatory system to keep viruses and bacteria out of the CNS, control the nutrient (glucose) supply to neurons, destroy and remove diseased and dead neurons, and provide axons with their myelin sheath, which is important for action potentials to be carried down axons (more on this later in the chapter). Glial cells also serve to establish, maintain, and rebuild synapses. As well, discoveries over the past two decades have confirmed that certain glial cells also respond to and modulate communication between neurons (Bazargani & Attwell, 2016; Murphy-Royal, Dupuis, Groc, & Oliet, 2017) and perform other essential functions.

There are several categories of glia: *astroglia*, which create a structure called the blood-brain barrier; *oligodendroglia*; and *Schwann cells*, both of which are myelinating glia; as well as *ependymal cells* and *microglia* (Jäkel & Dimou, 2017; Scheller & Kirchhoff, 2016).

Astroglia are so named because most are shaped like stars. This glial type is important for creating the blood–brain barrier, a system that regulates the passage of molecules from the blood to the brain (Verkhratsky, 2016; Verkhratsky, Nedergaard, & Hertz 2014). The processes that you see extending from the green cell body of the astrocyte (see photo) have endings on them called *astrocytic feet*. These feet wrap closely around the arteries and capillaries that carry blood into the brain. This creates a tube-like covering that is relatively impermeable and prevents most bacteria, viruses, and toxins from entering the brain. Astroglia also regulate the flow of blood into different brain regions as those regions increase or decrease in neuronal activity, thus providing more or less nutritional support or oxygenation as required (Nortley & Attwell, 2017; Rosenegger, Tran, Cusulin, & Gordon, 2015). Astroglia also function to absorb or clean up chemicals released by neighbouring neurons and to provide important growth-promoting molecules to neurons. Astroglia migrate to the site of brain injury, where they enlarge and multiply to form a glial scar (Karve et al., 2016). In addition, astrocytes play a modulating role in neuronal communication (Covelo & Araque, 2016; Giaume & Oliet, 2016).



Riccardo Cassiani-Ingoni/Science Source

Astroglial cell **Astroglial cells play a critical role in the creation of the blood–brain barrier. However, all types of glial cells are essential for brain function.**

Oligodendroglia (found in the central nervous system) and *Schwann cells* (found in the peripheral nervous system), are important for providing a protective fatty sheath, or coating, called *myelin* that insulates the axons of neurons from nearby neuronal activity (Scheller & Kirchoff, 2016). This protective function is particularly important in the brain and spinal cord, where neurons are very closely packed and axons are often organized into bundles (refer to Figure 3.8 for an image of the myelin sheath.). Importantly, myelin, which wraps in layers around an axon, also speeds up and maintains the passage of electrical signals down the axon (Nave & Werner, 2014). Multiple sclerosis is a progressive disease that involves demyelination, or loss of myelin, on the axons of neurons in the central nervous system. Demyelination occurs when the affected person's immune system attacks the myelin sheath. Loss of myelin leads to inefficient transmission of electrical information between neurons, causing a range of symptoms including vision loss, pain, and muscle weakness (depending on where the demyelination has occurred). Research on multiple sclerosis has focused on finding ways to stimulate remyelination in the CNS (Ontaneda et al., 2016).

Ependymal cells are specialized neuroglial cells that line the walls of the ventricles, fluid-filled spaces within the brain. They create and secrete cerebrospinal fluid (CSF) that fills the ventricles and surrounds the brain and spinal cord, and are thought to make up the blood–cerebrospinal fluid barrier (Brinker et al., 2014; Ohata & Alvarez-Buylla, 2016). Finally, *microglia*, so named because they are very small, are important for cleaning up the debris of degenerating or dead neurons and glia so that brain regions can continue with their normal functioning. This cleaning function makes microglia an important brain defence against infection and illness (Colonna & Butovsky, 2017; Wolf, Boddeke, & Kettenmann, 2017).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

16. What are the two types of cells in the nervous system?

17. What are types of glia and the functions of each type?

18. What are the parts of a neuron and what do they do?

What Do You Think? • Why do you think the function of glia was overlooked by researchers for so long? Why do you think neurons come in different shapes? How do you think the shape of a neuron influences the function of that neuron, and where it is found in the nervous system?

How Do Neurons Work?

LEARNING OBJECTIVE 5

Describe what happens when a neuron "fires" and how neurons communicate with one another to produce behaviour, become familiar with neural networks and neuroplasticity.

As one of the two basic cells in the central nervous system (CNS), neurons process all of the motor, sensory, and cognitive information that enters, leaves, or is created within the CNS. Everything we smell or taste, see or dream, plan, think, remember or feel is handled by neurons. Processing this sheer amount of diverse information means that we not only need many types of neurons, but we also need a *lot* of them. In fact, fairly recent research suggests that we have about 200 specific types of neurons, conservatively totalling about 86 billion neurons in the brain (Herculano-Houzel, 2014; von Bartheld, Bahney, & Herculano-Houzel, 2016), each communicating with somewhere between 5000 to 200,000 other neurons. This means that the number of synapses or points of neuron-to-neuron communication in the brain is in the neighbourhood of quadrillions (a quadrillion is a thousand trillions, 10^{15}).

So how do neurons communicate? As you saw in the last section, neurons are separate entities from one another. To communicate with one another, a signal has to be sent from the neuron cell body, down the axon, to the axon terminals in the first (presynaptic) neuron. At the axon terminals, a signal must be sent from this presynaptic neuron to a second postsynaptic neuron across the synaptic space between the two neurons. This communication between neurons is done via complex electrochemical interactions. In its most simple form, an electrical signal is generated at the cell body of the presynaptic neuron. This electrical signal, called an action potential, travels down the axon to the axon terminals, where chemicals called neurotransmitters, such as dopamine, are released from the axon terminals. These chemicals float across the synaptic space between neurons and bind to neurotransmitter receptors, usually found on the dendrites, on the next neuron. When these neurotransmitters bind to the next neuron, they may change the electrical

activity of that neuron, which can start this whole process going again. In the next several sections, we will take a closer look at this process, starting with explaining what a neuron is like in a resting state, how an action potential is generated, and finishing with a discussion of several classic neurotransmitters and how they facilitate communication between neurons.

The Resting Potential

In the 1950s, neurophysiologists Alan Hodgkin and Andrew Huxley carried out a series of experiments to identify the mechanisms that underlie how neurons communicate with one another (Hodgkin & Huxley, 1952). The discoveries they made eventually led to a Nobel Prize for their work in 1963 (Nobel Prize, 2013). Their work revolutionized our understanding of how the nervous system communicates both within itself and with the rest of the body. (For an example of the CNS communicating with the rest of the body, revisit the reflex circuit in Figure 3.2.) Subsequently, it has been shown that the neural communication system they discovered is the same in all animal species, including humans. Our evolutionary heritage, and our descent from a common animal ancestor, is why the study of how neurons work in different animals is relevant for understanding the workings of our own nervous systems. Neurons in all animal species communicate with one another using the same signalling systems. (See the section Evolution and the Nervous System for an introduction to the theory of evolution later in this chapter.)

Hodgkin and Huxley used large axons from squids (axons are similar to tubes with water inside) to first work out the internal state of a neuron when it is at rest, or not communicating with another neuron. Sections of squid axons were placed in a dish with fluid surrounding them (called a bath), similar to the watery environment these axons would be found in within an animal. Squid axons were chosen for this work due to their large size (diameter), which made it easy to place a recording electrode inside the axon (**Figure 3.10**). What they found when they placed an electrode inside the axon, and compared it with a reference electrode placed in the bath outside the axon, was that the inside of the axon relative to the outside bath was negative! This was an incredible and unexpected discovery that provided the basis for our understanding of how neurons communicate with one another.

The negative difference on the inside of the axon relative to the outside makes a neuron *polarized*, and a neuron in this polarized state is sitting at its **resting potential**. This resting potential can vary slightly between different animal species, from –80 mV (millivolts) to –50 mV, but it is typically between –65mV and –70mV. Keep in mind as you read through these next sections that scientists are recording an electrical difference in the thousandth of a volt and often require specialized electronic amplifiers to boost the signal so it can be recorded on an oscilloscope (the technology used by Hodgkin and Huxley) or a computer. Compare this in your mind with a typical electrical wall socket in your house, which is 120V, or 120,000 mV. The electrical signals used by your nervous system are incredibly small compared with the electrical current available in your home.

resting potential the electrical charge of a neuron when it is at rest.

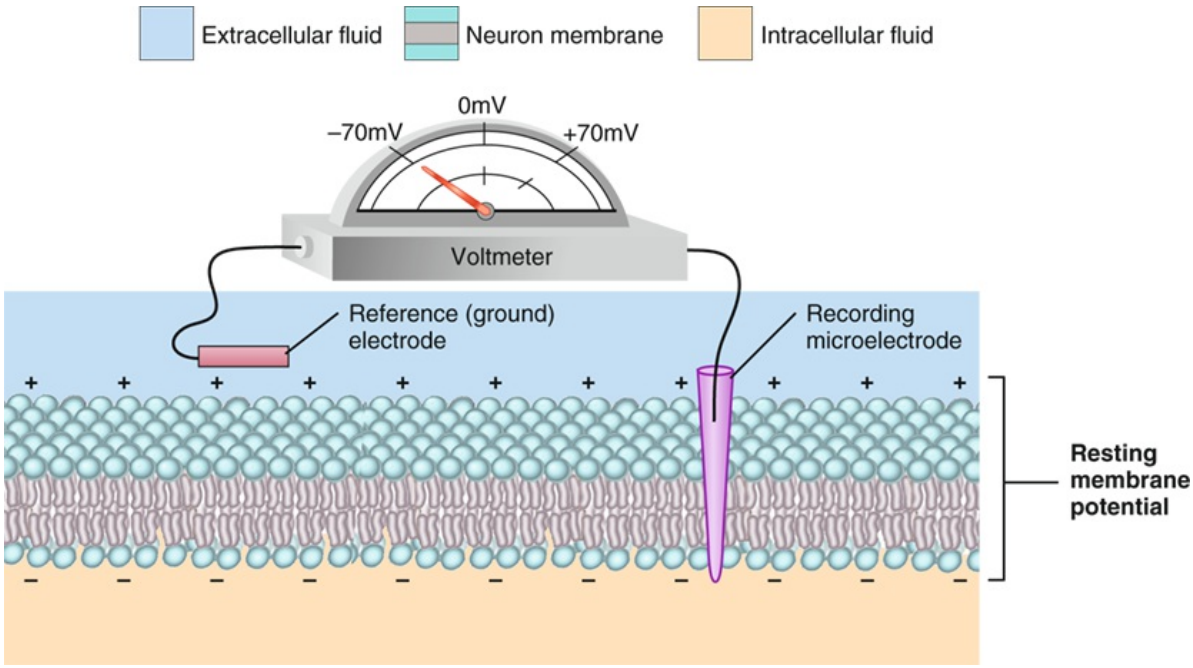


FIGURE 3.10 Measuring the Resting Membrane Potential The resting membrane potential is recorded by comparing the measurement of a recording microelectrode placed inside the cell, into the intracellular fluid, and comparing that to a ground or reference electrode that is placed in the extracellular fluid that surrounds the neuron. If the recording microelectrode was placed in the extracellular fluid, alongside the reference electrode the difference between them would be zero. It is only when the recording microelectrode is placed into the neuron that you see a difference in the voltage between the two microelectrodes. This difference is the resting membrane potential, which can be seen on the voltmeter in this diagram. Reprinted with permission of John Wiley & Sons, Inc., from Derrickson B.H. (2019). *Human physiology*. 2nd ed. Hoboken, NJ: J. Wiley.

For a neuron to create this resting potential, it is important to be aware of several key elements, or factors, that keep the inside (intracellular) environment of a neuron and its axon negative relative to the liquid extracellular environment that it is bathed in. These key elements are the relative imbalance of positively and negatively charged ions inside versus outside the neuron, the semi-permeable nature of the cell membrane, electrostatic pressure and concentration gradients, and the sodium-potassium pump.

The Role of Ions

Ions are negatively or positively charged atoms or molecules that can be found in the intra and extracellular fluid of a neuron. If the membrane surrounding a neuron was 100% permeable, these ions could pass through the cell membrane freely and would be found in equal numbers on the inside and outside of the cell. This is not the case, however, since a neuron is covered by a multilayered semi-permeable membrane (Figure 3.11). What this means for a neuron is that not all ions can easily pass through this membrane unless there is an open hole or channel in the membrane that allows for passage of these ions. This semi-permeable membrane allows a neuron to keep some ions inside and some outside

when channels in the membrane stay closed.

Neurons contain several types of ions that are important for the resting potential, and whose movement across the cell membrane is critical for the formation of an action potential. In a typical neuron, there are three main ions that are important for understanding the resting potential and action potential (see next section): negatively charged proteins (A^-), which are large molecules found primarily inside the cell, and positively charged sodium (Na^+) and potassium (K^+) ions. At the resting potential, there are far more K^+ ions inside the cell than outside, and the opposite is true for Na^+. If the cell membrane were permeable, we would expect the number of Na^+ and K^+ to be similar on either side of the membrane, but this isn't the case due to the semi-permeable membrane that surrounds a neuron.

Semi-Permeable Membrane

If you look carefully at Figure 3.11, you can see that there are several large objects that span the semi-permeable cell membrane. These objects are called **ion channels** and they regulate the flow of ions in and out of the cell. In the resting state, the majority of these channels are closed, especially the ones for Na^+. For K^+, some of these channels are open, letting a bit of K^+ move between the inside and outside of the neuron. The large negatively charged proteins (A^-) don't have channels to pass through and are found primarily inside the cell (Bear, Connors, & Paradiso, 2020). These A^-provide the primary basis for the negativity of the cell on the inside relative to the outside that is found during the resting state.

> **ion channels** pores in the cell membrane that can open and close to allow certain ions into and out of the cell.

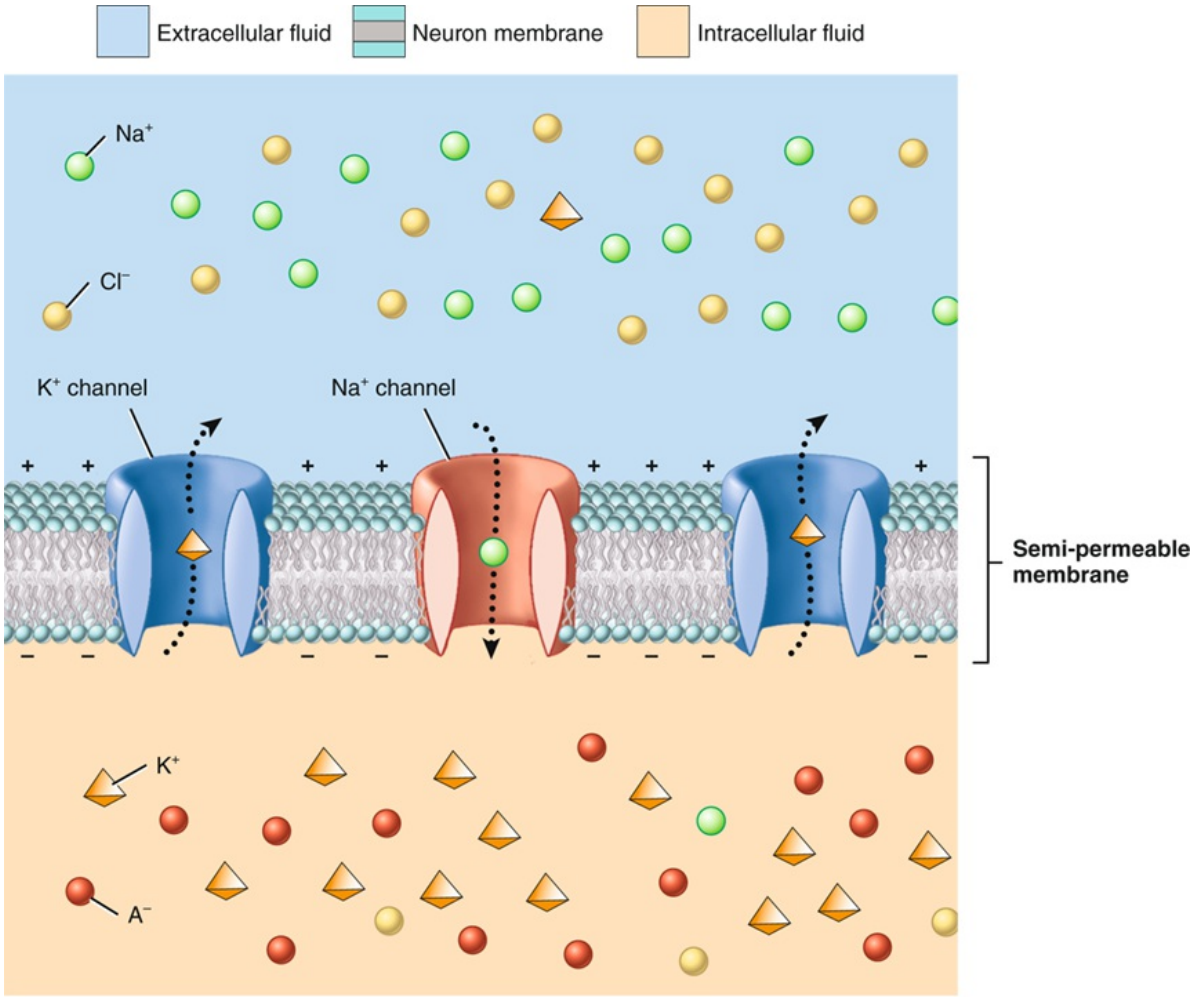


FIGURE 3.11 Distribution of Ions across the Cell Membrane Ions are not equally distributed across the membrane of a neuron during the resting membrane potential state. As can be seen in this diagram there are more sodium (NA^+) ions on the outside of the cell than on the inside. In contrast there are more potassium (K^+) ions on the inside of the cell during the resting membrane potential state. These ions can move in and out of a neuron when channels in the cell membrane are open, as shown here, which occurs during different phases of the action potential (see Figure 3.12). The negative (A^-) protein molecules on the inside of the cell cannot leave the cell due to their size. Chloride (Cl^-) and calcium (Ca^{2+}) (not shown) are also found in the intra and extracellular fluid of a neuron. These two ions will be discussed later in this section when we discuss Communication Across the Synapse. Reprinted with permission of John Wiley & Sons, Inc., from Derrickson B.H. (2019). *Human physiology*. 2nd ed. Hoboken, NJ: J. Wiley.

Electrostatic Pressure and Concentration Gradients

Since the channels for Na^+ are typically closed, Na^+, which is found at higher concentrations outside the neuron cell wall during the resting potential, can't get inside. These ions are, however, attracted to the inside of the cell due to its internal negativity from the negatively

charged proteins. When positive ions move toward a more negative space, they are being drawn to that location by a force called **electrostatic pressure**. This drive for Na^+ to enter the inside of the cell due to the negative internal environment is combined with the affinity for ions to move from areas where they are highly concentrated (the extracellular space is where most Na^+ ions are found during the resting potential) to areas where there is a lower concentration of them. In scientific terms, we call this movement of ions from areas of high to low density as movement down their **concentration gradient**. The combination of the electrostatic pressure and concentration gradient drive means that the Na^+ ions will sit around the outside of the neuron cell membrane waiting to enter. While Na^+ ions are predominately found on the outside of the neuronal cell wall, during the resting potential, K^+ ions are primarily found on the inside of the neuron. Some channels in the cell membrane for K^+ open and close during the resting membrane potential, allowing for a small amount of movement of K^+ ions. The reason that they don't all leave the cell is due primarily to the effect of electrostatic pressure. Since the inside of the cell is more negative, they are drawn back inside. The amount of K^+ ions inside is not enough to balance out the number of large negatively charged proteins A^- and so the resting membrane potential is maintained at around –65mV to –70mV.

electrostatic pressure the force that drives ions that are of a similar charge away from one another or attracts two ions of opposite charges toward each other.

concentration gradient the difference in concentration of sodium ions inside and outside of the neuron.

Sodium-Potassium Pumps

The final element that helps to maintain the negative polarization across the neuronal cell membrane is the **sodium-potassium pump**. These are proteins inserted into the neuronal cell wall that work like a turnstile you might see in a subway, or at a large concert or sporting venue. These proteins are constantly pushing Na^+ ions outside the cell and bringing K^+ ions back into the cell at a ratio of 3 Na^+ ions out and 2 K^+ ions in. In any given neuron there may be thousands of these pumps working throughout the cell membrane to maintain the Na^+/K^+ balance. Interestingly, this process is one of the major consumers of the glucose your brain uses for energy (Breedlove & Watson, 2020)!

sodium-potassium pump protein molecules in the membrane of cells that push out sodium ions and push in potassium ions.

Another way to think of a neuron during the resting membrane potential is like a battery. When the current is allowed to flow—in this case, ions moving down their electrostatic pressure and concentration gradients—you will get a change in electrical output. The negative charge on the inside of the neuron relative to the outside will change if Na^+ and K^+ ions are allowed to move according to their concentration gradients and the effects of electrostatic pressure. When Na^+ and K^+ ion channels in the membrane open, and these ions are allowed to move freely across the membrane, this is exactly what occurs. For a

brief period, the recording electrode inside of the neuron will record a positive value relative to the outside reference electrode. This change in polarization is part of the neuronal communication process that is called the **action potential**.

> **action potential** a sudden positive change in the electrical charge of a neuron's axon, also known as a spike or firing; action potentials are rapidly transmitted down the axon.

The Action Potential

The action potential, also called a "spike" or "neuron impulse," occurs when enough sodium enters the cell to push the relative electrical difference across the membrane to around −40 mV. This voltage is the **threshold** for the initiation of an action potential (**Figure 3.12**). When the axon of a neuron, at the point where it leaves the cell body (called the axon hillock), senses that this −40 mV threshold has been reached, the axon responds by opening Na^+ voltage-sensitive ion channels that are embedded in the cell membrane of the axon. When these voltage-sensitive channels open, Na^+ ions rush inside the cell to balance the electrostatic pressure and the concentration gradient for Na^+ ions. There is so much movement of Na^+ into the cell that for a brief period (milliseconds), the inside of the cell becomes positive relative to the outside. When the inside of the cell reaches approximately +40 mV relative to the outside, a second set of voltage-sensitive channels open: these are K^+ channels. These voltage-sensitive K^+ channels allow for K^+ ions to rush out of the cell as they attempt to balance their own electrostatic pressure and concentration gradient. At the same time as the voltage-sensitive K^+ ion channels open, the Na^+ ion channels close and stay closed for a set amount of time. (This switch in opening and closing of the K^+ and Na^+ ion channels occurs at approximately +40 mV). This movement of K^+ ions out of the cell, when Na^+ ions can no longer enter the cell, is called the repolarization phase of the action potential. During this time, so much K^+ leaves the cell that it briefly becomes hyperpolarized. The inside relative to the outside is even more negative than when the neuron is at its resting potential. This oscillation of opening and closing of voltage-sensitive Na^+ and K^+ ion channels sets up a chain reaction that moves down the axon toward the axon terminals and leads to neurotransmitter release (see **Figure 3.13**). At the end of the action potential, there is a short period when voltage-sensitive Na^+ ion channels are still closed and another action potential cannot be fired. This **absolute refractory period** is a common feature of all neurons; however, it can be really short. There are species of electric fish that can generate up to 1000 action potentials a second from their tails (Thompson et al., 2018)! During the absolute refractory period, and **relative refractory period**, where an action potential can be fired but the neuron will require more stimuli than usual to start this process, the hundreds and thousands of sodium potassium pumps located in the cell membrane are hard at work. These pumps, which operate continuously during the resting and action potential states, assist in re-establishing the resting potential of the membrane to prepare the neuron for the next action potential (Zecevic & Popovic, 2015).

> **threshold** the point at which the relative influence of other neurons succeeds in causing a neuron to initiate an action potential.

absolute refractory period a very brief period of time after an action potential, during which a neuron is completely unable to fire again.

relative refractory period a brief period just after the absolute refractory period during which a neuron can fire only if it receives a stimulus stronger than its usual threshold level.

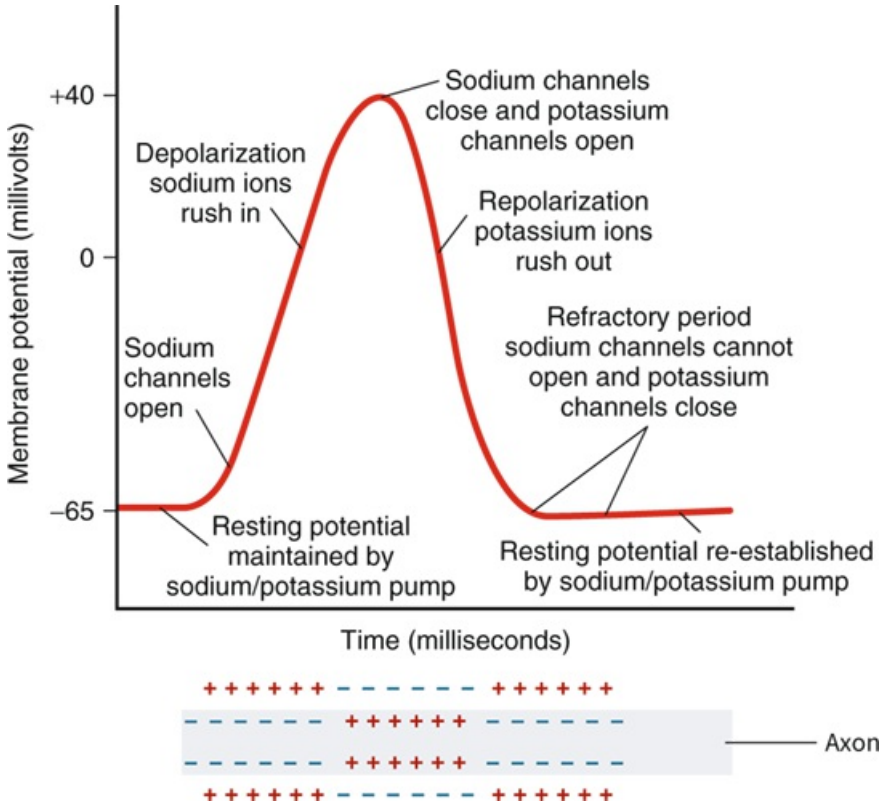
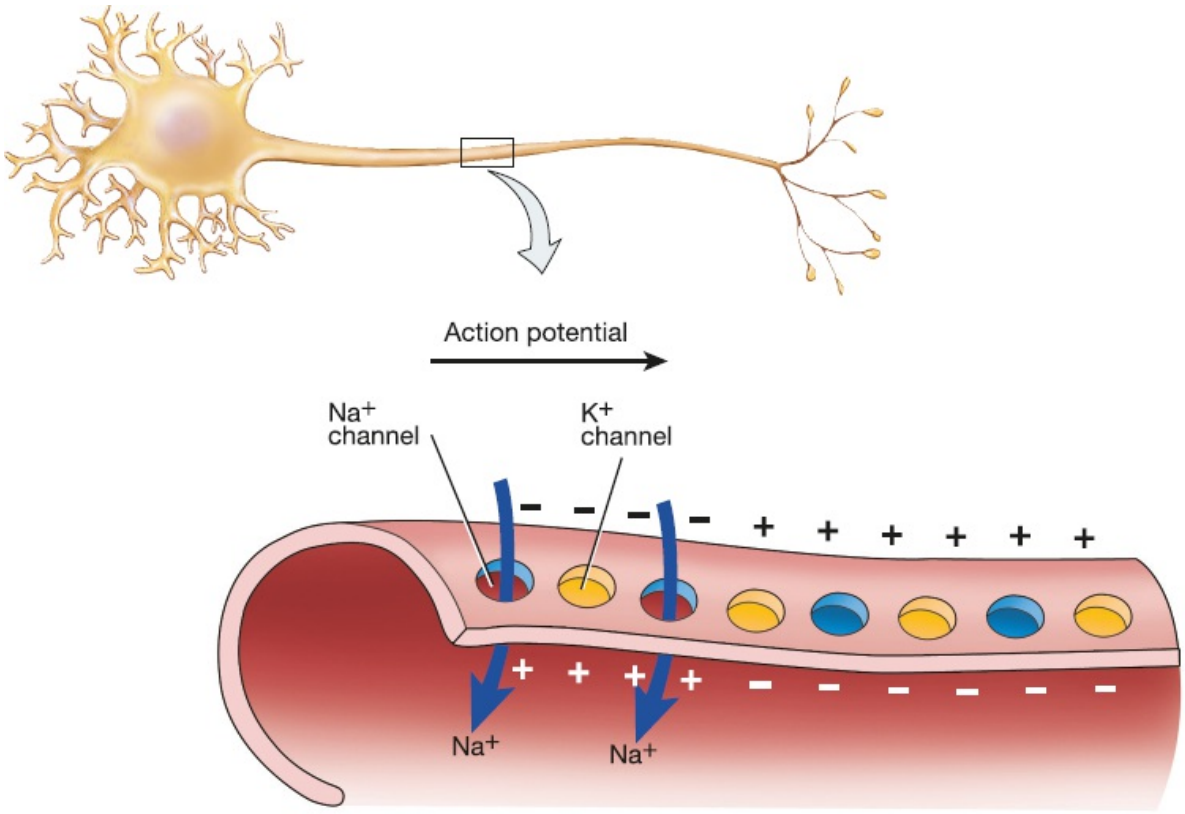
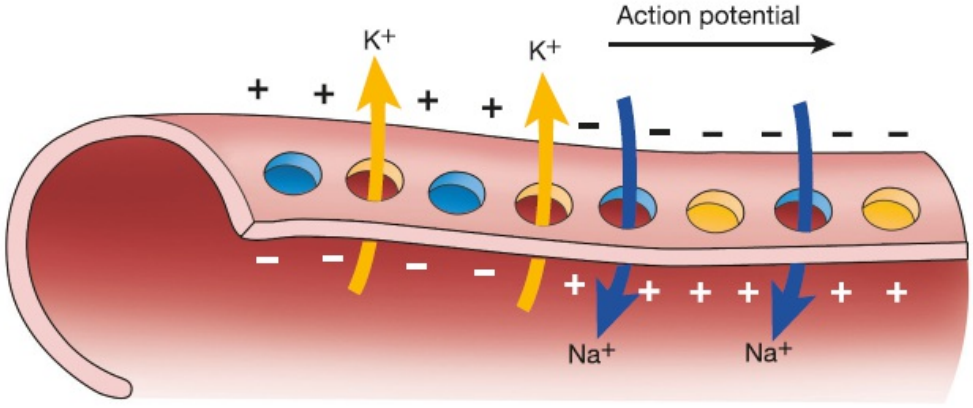


FIGURE 3.12 The action potential When a neuron is stimulated, a very rapid reversal of the membrane potential occurs as the potential changes from about −65 mV to about +40 mV and back again. This change in voltage (sometimes called a spike or a neuron impulse) is the action potential (red line). This change in the voltage difference across the membrane during an action potential is due to the opening and closing of sodium and potassium channels at different times during the action potential as can be seen on this figure. The axon below the graph depicts the change in the internal relative to the external charge difference across the membrane during the different stages of the action potential.



(a) When stimulated by a sufficiently strong signal, an "at rest" (polarized) axon become depolarized, creating an action potential. The affected section of the axon opens sodium channels embedded in the axon membrane and positively charged sodium ions (Na^+) rush into the axon, changing the previously negative charge inside the axon to a positive charge.



(b) The depolarization produces an imbalance of ions in the adjacent axon membrane, causing the action potential to move down the axon (in a manner similar to people doing "the wave" at a football game). As the action potential moves down the membrane, the initially depolarized section closes the sodium channels and opens potassium (K^+) channels, allowing K^+ ions to flow out. This allows the first section to repolarize, restoring the resting potential.

FIGURE 3.13 The action potential

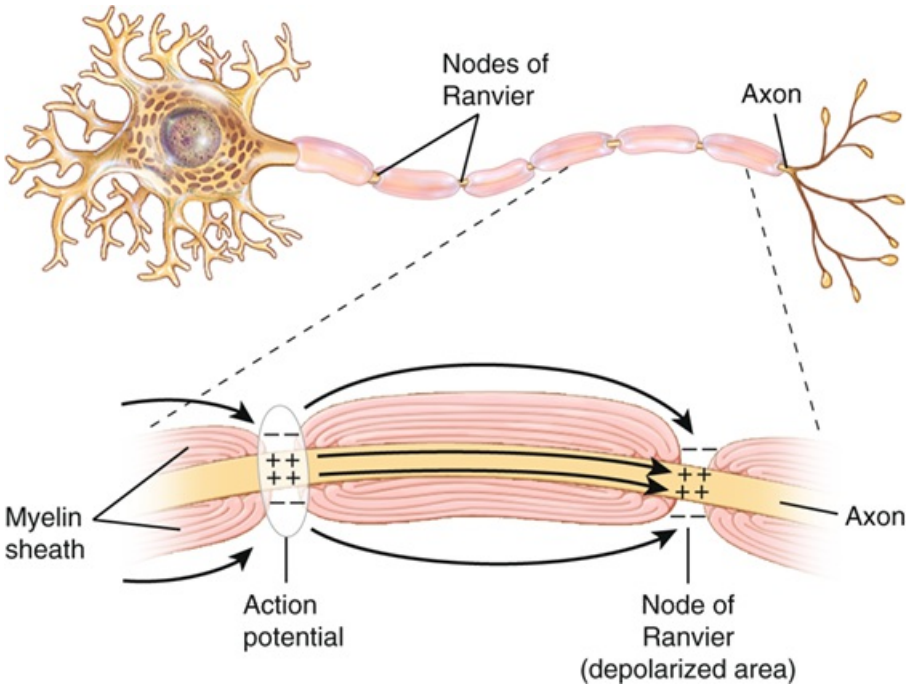


FIGURE 3.14 Nodes of Ranvier The nodes of Ranvier are the regions of exposed axon between areas wrapped in myelin. Action potentials travel down the axon by jumping from node to node.

Action potentials are not graded—that is, there are not weaker or stronger action potentials. Instead, action potentials follow the *all-or-none* principle. Since action potentials are all-or-none, either initiated or not, they don't convey a lot of specific information. If the excitatory input to a neuron exceeds a certain threshold, it fires; otherwise, it does not. Think of the firing of a gun: if you squeeze the trigger, the gun either fires or it doesn't. Once fired, regardless of how hard you squeezed the trigger, the bullet has only one velocity. So, how does a neuron pass on information indicating that one stimulus is more intense than another? Stronger stimuli cause more neurons to fire more often; thus, higher frequencies of action potentials send information about more intense stimuli (Kostal & Lansky, 2015). The pattern of action potentials, whether they occur in rapid succession or at a slow pace, whether they are regular or more sporadic, can therefore provide a specific neural code.

To facilitate the movement of the action potential down the axon, the axons of many neurons are surrounded and insulated by **myelin**, a white fatty layered coating produced by specialized glial cells. At regularly spaced gaps (*nodes of Ranvier*) in the myelin, the neuronal membrane is exposed to the extracellular fluid, which contains high concentrations of sodium, which rushes into the cell when voltage-sensitive Na^+ ion channels open at the node of Ranvier. An easy way to think about this is a cellphone signal that jumps from tower to tower with the signal boosted at every tower. As **Figure 3.14** shows, action potentials travel very quickly down myelinated axons by jumping from node to node in a process known as *saltatory conduction*.

myelin a fatty, white substance formed from glial cells that insulates the axons of

many neurons.

Communication Across the Synapse

Once the positive charge of an action potential reaches the axon terminal, it initiates actions that enable the passage of information to other neurons. As you have already learned, neurons are not physically connected to one another; they are separated by small gaps. These gaps, called **synapses**, are tiny spaces (about 20 nm or 0.00002 mm wide) between the axon terminal of one cell and the dendrite of another cell. As previously mentioned, communication across these spaces often involves specialized chemicals called **neurotransmitters**. Neurotransmitter molecules are usually contained within small **synaptic vesicles** in the axon terminal, also known as the *presynaptic* terminal, of the neuron sending information. It is the binding of these synaptic vesicles with the presynaptic membrane that allows them to empty their neurotransmitter contents into the synaptic cleft. **Table 3.1** lists some major neurotransmitters, their associated functions, and some drugs (many of which we will return to in more detail in Chapter 6) that can be used to manipulate these neurotransmitter systems. Later in this section you will see that certain neurotransmitters are also associated with specific brain regions.

synapses tiny spaces between the axon terminal of one neuron and the neuron through which chemical communication occurs.

neurotransmitters specialized chemicals that travel across synapses to allow communication between neurons.

synaptic vesicles membrane-bound spheres in the axon terminals of neurons in which neurotransmitters are stored before their release.

Role of Neurotransmitters in Generating Action Potentials

There are two more ions that are important for understanding how neurons communicate with one another through action potentials and neurotransmitters calcium (Ca^{2+}) and chloride (Cl^-). When an action potential reaches the axon terminals, Ca^{2+} voltage-sensitive ion channels open, allowing calcium to flow into the terminals (**Figure 3.15**). Calcium is critical for the binding and fusing of the synaptic vesicles to the presynaptic cell membrane of the axon terminals. Once the synaptic vesicle has fused with the membrane, the neurotransmitter contained inside is released into the synaptic cleft and diffuses across the cleft to bind to neurotransmitter receptors on the dendrites of the postsynaptic neuron. **Neurotransmitter receptors** are proteins in the cell membrane that recognize specific molecules. They operate in a lock and key fashion such that receptors can only receive the specific neurotransmitter that "fits" into them (Carlson, 2013). There are perhaps 100 or more different neurotransmitters, including those listed in Table 3.1, and many of these neurotransmitters "fit" and activate several different receptor subtypes (Zorumski & Rubin, 2011). We will discuss neurotransmitters, how they work, some of the different types of neurotransmitters and their effects on behaviour, in the next several sections.

neurotransmitter receptors proteins in the membranes of neurons that bind to

neurotransmitters.

TABLE 3.1

Common Neurotransmitters and Drugs Associated with Each

Neurotransmitter	Function	Associated Drugs
Glutamate	Learning and memory, movement, emotions, cognition	Ketamine
GABA	Learning, anxiety regulation	Valium (diazepam, used to relieve anxiety, muscle spasms); Ambien (Zolpidem, used to treat insomnia)
Acetylcholine (ACh)	Learning, attention, movement of muscles	Nicotine
Dopamine	Movement, reward learning, addiction	Cocaine; heroin; methamphetamine
Serotonin	Mood regulation, sleep, memory	Ecstasy (MDMA); LSD (hallucinogens); monoamine oxidase inhibitors (MAOIs), selective serotonin reuptake inhibitors (SSRIs; antidepressants)
Norepinephrine	Attention, arousal	Adderall (a stimulant made up of dextroamphetamine and amphetamine)

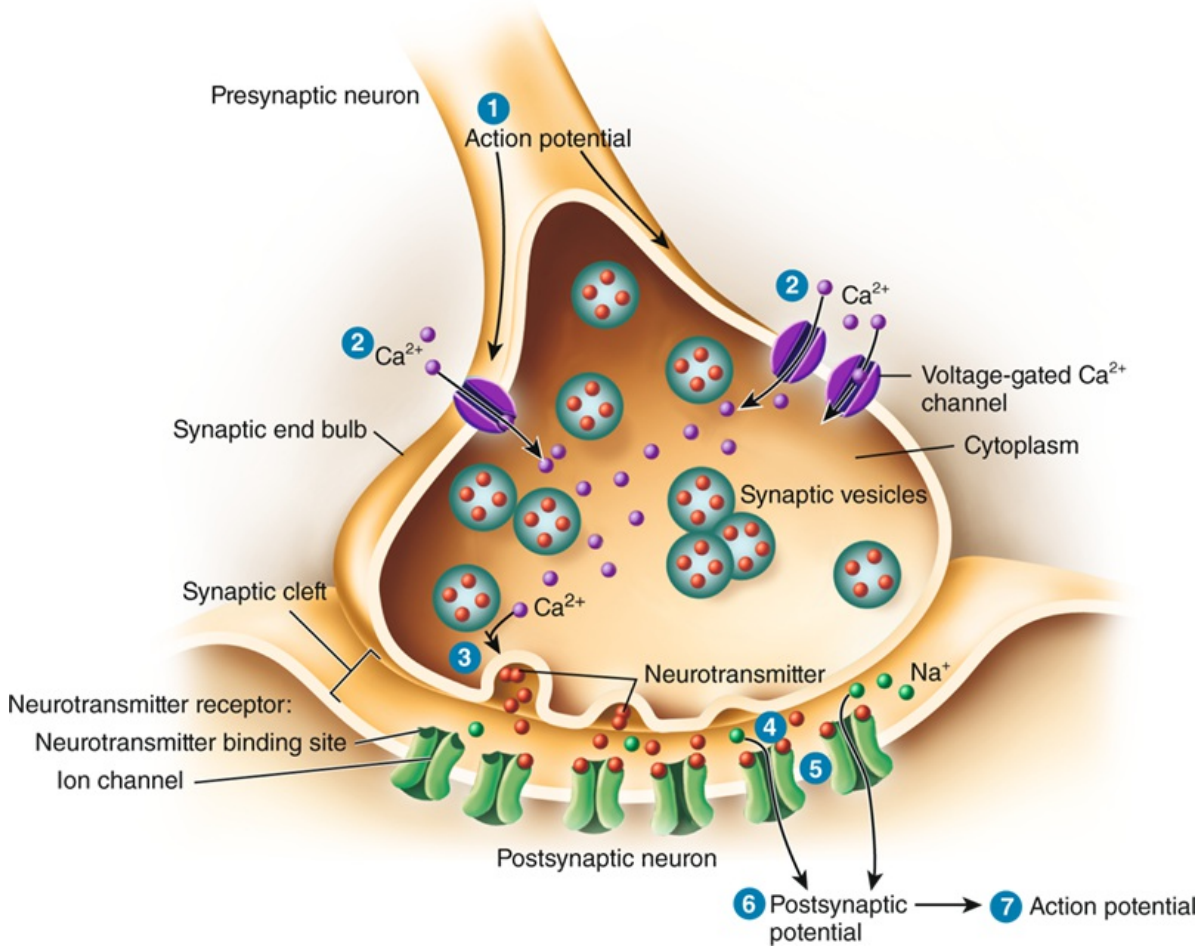


FIGURE 3.15 The Role of Neurotransmitters Once an action potential has traveled down the axon (1) it reaches the synapse. At the synapse several things occur to facilitate communication with the next neuron. Calcium channels (2) open allowing Ca^{2+} ions to enter the cell. This influx of Ca^{2+} ions promotes the fusion of synaptic vesicles, which carry neurotransmitter molecules, to the neuron membrane. The synaptic vesicles that fuse with the cell membrane (3) can release their neurotransmitters into the synaptic cleft where they can bind with receptors on the postsynaptic neuron (4). This binding of neurotransmitters can open Na^+ channels (5) in the next neuron. This allows Na^+ ions to flow into the postsynaptic neuron decreasing the voltage across the membrane (6) and setting the stage for the generation of an action potential in the post synaptic neuron (7). Reprinted with permission of John Wiley & Sons, Inc., from Derrickson B.H. (2019). *Human physiology*. 2nd ed. Hoboken, NJ: J. Wiley.

As discussed previously, when a neurotransmitter binds to a receptor, the combination stimulates an electrical event in the postsynaptic membrane. These electrical events, called **postsynaptic potentials**, can be *excitatory* or *inhibitory*. The electrical response of the postsynaptic cell is determined by the receptor. If the neurotransmitter when bound to its receptor has an excitatory action, that is, it opens an ion channel that allows Na^+ to enter the cell, then the postsynaptic cell will be depolarized and the voltage difference across the

membrane, inside relative to outside, will become less negative. Glutamate for example, is commonly associated with letting Na^+ flow into a cell and generating action potentials in the postsynaptic neuron. **Depolarization** that arises from inputs of a single neuron may not be great enough to reach threshold and trigger an action potential in the postsynaptic neuron, but they can be summed together with other depolarizations that occur close together with them in time and location on the postsynaptic membrane. In this way, the threshold will be reached and the neuron will fire, sending the information on to the next neuron in the chain. Alternatively, if the receptor has an inhibitory action for example, it lets chloride ions (Cl^-) flow into the cell, which is the typical action of the neurotransmitter GABA, then the postsynaptic cell may become hyperpolarized: the difference in the relative charge across the membrane will be more negative. **Hyperpolarization** makes it less likely that the postsynaptic neuron will fire an action potential.

> **postsynaptic potentials** electrical events in postsynaptic neurons that occur when a neurotransmitter binds to one of its receptors.
>
> **depolarization** what occurs when the inside of the neuron membrane becomes *less* negative relative to the outside.
>
> **hyperpolarization** what occurs when the inside of the neuron membrane becomes *more* negative relative to the outside.

Repeated release of neurotransmitters into the synapse can result in long-lasting changes at the synapse in both presynaptic and postsynaptic neurons. Postsynaptic effects can include changes in the numbers and sensitivity of neurotransmitter receptors. According to Costa-Mattioli and his colleagues at McGill University (Huang et al., 2013), such effects may play a key role in memory consolidation. We will discuss consolidation further in Chapter 8.

Termination of Neurotransmitter Activity at the Synapse

Once a neurotransmitter has been released into the synaptic cleft one of two processes terminates the activity of the neurotransmitter and halts the communication. This process of termination is essential or the postsynaptic receptor could be blocked from receiving further input, or neurotransmitter molecules could accumulate in the synapse, obscuring future discrete chemical signals. The first process is *enzymatic degradation* and involves the breaking down of the neurotransmitter that remains in the synaptic cleft by specialized enzymes or proteins (see Figure 3.15). Often the products of the breakdown are taken back into the presynaptic neuron and used to synthesize additional neurotransmitter molecules. An example of a neurotransmitter inactivated by an enzyme is acetylcholine (broken down by an enzyme called *acetylcholinesterase in the synaptic cleft*). The second, more common, process is known as *reuptake*; in this process, functional neurotransmitter molecules are drawn back into the presynaptic neuron and recycled for future use. Examples of neurotransmitters terminated mostly by reuptake are norepinephrine, dopamine, and serotonin (Bear, Connors, & Paradiso, 2020; Shao et al., 2014). Drugs such as the selective serotonin reuptake inhibitors (SSRIs) commonly used to treat depression (e.g., fluoxetine, trade name Prozac) inhibit (as its name would suggest) the reuptake of serotonin, thereby increasing the total amount of serotonin available in the synapse (Cowen & Lucki, 2011).

At this point, you have now covered the basics of a neuron's resting potential, the action potential, and how neurotransmitters carry a signal from one neuron to the next. So why do we (or should you) care? First and foremost, all of the drugs we take to change our moods —such as anxiety and depression—work by changing the way neurons communicate with one another. If you feel fear (see Chapter 11), this is due to the action potentials being sent between neurons in the prefrontal cortex and the amygdala. In extreme cases, the information sent to the prefrontal cortex via signals from the amygdala can become overwhelming and a person can end up with a disorder such as posttraumatic stress disorder. Finally, when we all go to the dentist, and need work that requires freezing, this freezing works primarily by blocking voltage-sensitive Na^+ ion channels. Our guess is that we are all glad that no pain signals (action potentials) are getting to the brain during invasive dental work. These are only a few of thousands of reasons for why understanding the way neurons communicate has improved our lives.

Neurotransmitters and Their Functions

Now that you have a basic understanding of the crucial role that neurotransmitters play in generating action potentials, let's examine a few specific neurotransmitters in greater detail. First, although something of an oversimplification, neurotransmitters can be identified by function—that is, as excitatory (causing action potentials to be generated) or inhibitory (preventing action potentials from being generated). However, some neurotransmitters can be both excitatory or inhibitory depending on the receptor type that they bind to. While beyond the scope of this book neurotransmitters can also change the internal working of a cell. For example, serotonin has over 15 different receptor subtypes that it can bind with, and the effects on neuron function are different for each type (Nautiyal & Hen, 2017). Although it is important to understand that these systems are complex, we will discuss only a few of the better understood neurotransmitters in the next section. Before we begin, however, please be aware that identifying specific behavioural or physical outcomes from a single neurotransmitter is complicated. Neurotransmitters play multiple complex roles, their functions often overlap or interact, and their effects can differ considerably depending on where they are released in the nervous system.

Acetylcholine

German biologist Otto Loewi isolated acetylcholine (ACh) in 1921. ACh is important for stimulating muscles and plays a key role in communicating between motor and sensory neurons. It is also important for attention, arousal, and memory, and plays a part in REM (dream) sleep. The venom from some snakes and spiders prevents the release of ACh into the synapse or blocks ACh receptors, disrupting or slowing motor control, often with fatal consequences (Filchakova, 2019). As well, the poison botulin prevents axons from releasing ACh, causing paralysis and death. Given in very small doses, Botox, a derivative of the poison botulin, temporarily reduces wrinkles by preventing nerve cells from signalling to the muscles to contract (Satriyasa, 2019). Widespread loss of ACh is a key factor in Alzheimer's disease (Craig, Hong, & McDonald, 2011; Ferreira-Vieira, Guimaraes, Silva, & Ribeiro, 2016).

RGR Collection/Alamy Stock Photo

Parkinson's disease In 1991, at only 30 years of age, Canadian actor Michael J. Fox, seen here with Doc in the film Back to the Future (1985) was diagnosed with Parkinson's disease. He went public with his diagnosis in 1998. He founded the Michael J. Fox Foundation for Parkinson's Research to support research and Parkinson's patient care, which has granted more than $650 million in research to date.

Dopamine

This neurotransmitter is associated with mood, control of voluntary movement, and reward mechanisms in the brain (Koob, 2013). A number of drugs increase dopamine levels including heroin, alcohol, opium, and nicotine. An excessive amount of dopamine in the frontal lobes is associated with schizophrenia (Kendler & Schaffner, 2011; Arnsten et al., 2017); drugs that block dopamine help to control the symptoms of schizophrenia. On the other hand, too little dopamine in the motor areas of the brain is implicated in Parkinson's disease (Sitte et al., 2017; Torrente, Gelenberg, & Vrana, 2012). Parkinson's disease is a neurological condition that involves the death of dopaminergic neurons—those that produce the neurotransmitter dopamine—in the substantia nigra (Blesa & Przedborski, 2016). (See photo.) A precursor drug to dopamine (L-dopa) helps alleviate some of the symptoms of Parkinson's disease (Ishii et al., 2016).

Norepinephrine

This neurotransmitter is also known as noradrenaline and is involved in stimulating the sympathetic nervous system, affecting arousal, vigilance, and mood (Critchley & Garfinkel, 2016). Strong emotions such as fear or anger cause an increase in heart rate and muscle strength, as well as increases in blood carbohydrate metabolism and respiration

(Zimmerman, Sawchuk, & Hochman, 2012). Norepinephrine constricts blood vessels, raises blood pressure, and dilates the bronchi. Norepinephrine also plays a role in learning, memory, sleep, and emotion (Hurlemann, Maier, & Scheele, 2016; Terbeck et al., 2016). People with depressive disorders may have low levels of norepinephrine, whereas excessive levels have been linked to anxiety (Hu et al., 2016).

Serotonin

This neurotransmitter is involved in the regulation of mood, appetite, and sleep (Cappadocia et al., 2009; Sangare et al., 2016) as well as in the perception of pain (Terry et al., 2016). Serotonin also plays a role in activity level (Anderson & Shivakumar, 2015) and cognitive functions such as learning and memory (Kuhn, Popovic, & Pezawas, 2014). Many antidepressant medications block the reuptake of serotonin, increasing the amount available to receptors in the synapse, and resulting in elevation of mood (Anderson and Shivakumar, 2013: Borrow & Cameron, 2014).

GABA (Gamma-Amino Butyric Acid)

GABA, the most common inhibitory neurotransmitter in the brain, reduces the activity of the neurons it binds to. GABA has been implicated in sleep (Chong, 2014) and associated with reduction of arousal of the nervous system. Abnormal levels have been implicated in eating disorders (Dennis & Pryor, 2014) as well as in epilepsy (Maru & Ura, 2014). As shown in Table 3.1, benzodiazepines such as Valium, which is often used to treat anxiety, mimic GABA by binding to, and activating, GABA receptors and reducing neural activity.

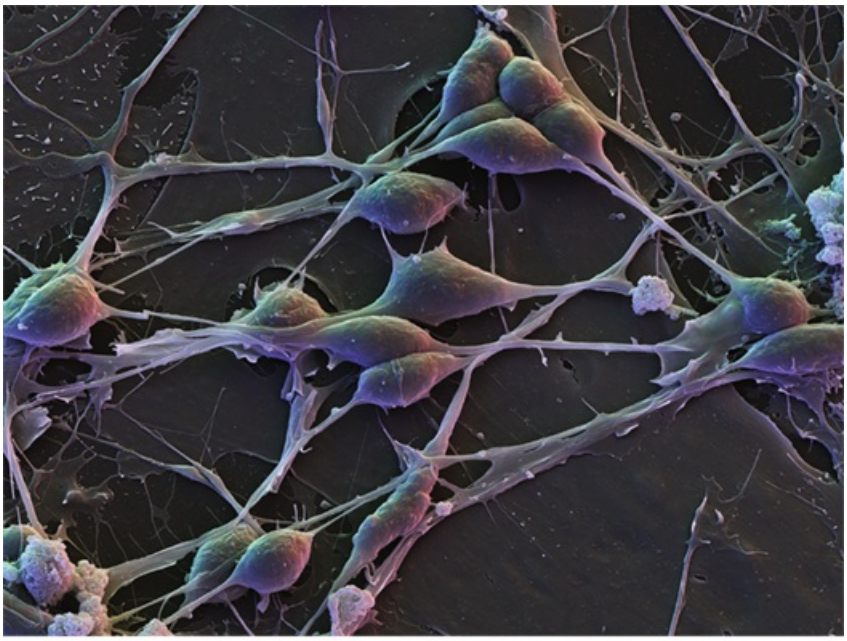
Glutamate

This neurotransmitter is believed to be the most important transmitter for normal brain function (Scofield et al., 2016). It is released by up to half of the brain's neurons and is therefore the most common excitatory transmitter in the brain (Guerriero, Giza, & Rotenberg, 2015). At normal concentrations, glutamate is involved in a wide range of behaviours and plays a central role in learning and in the formation of new memories (Peng et al., 2011). Ketamine, a drug targeting glutamate receptors, is now demonstrating promise for treating fears and phobias (Bloch et al., 2012) as well as depression (Abdallah et al., 2018; Lapidus et al., 2014; Mathews, Henter, & Zarate 2012). However, glutamate has also been implicated in neurodegenerative disorders such as Huntington's disease. Current research suggests that Huntington's may be related to excessive glutamate activation (excitotoxicity) causing particular neurons to die (Padowski et al., 2014). Huntington's disease is an inherited condition that results in the death of neurons in a part of the brain called the striatum. People suffering from this disease exhibit awkward movements and often show symptoms of psychosis (Tsuang et al., 2018). Like Parkinson's disease, Huntington's disease is progressive and, as yet, there is no cure.

Neural Networks

In the brain, neurons do not work alone or even in very small groups. A single neuron

cannot effect change of any kind on its own in a complex nervous system like ours. Instead, millions of neurons work in unison developing patterns of neural activity, firing together or in a temporal sequence or pattern to influence behaviour (Sala-Llonch, Bartrés-Faz, & Junqué, 2015). Collections of neurons that communicate with one another in a sequential fashion are referred to as *neural circuits* or *neural networks* (see photo). In his influential book, *The Organization of Behavior* (2002, 1949), Donald Hebb, perhaps one of Canada's most famous psychologists, inferred the existence of what he called *cell assemblies*, networks of neurons underlying complex cognitive behaviours. Hebb's description of cell assemblies was instrumental in shaping the current approach to the study of neural networks. Cell assemblies are networks of neurons that begin with essentially random connections, but become organized to work together as an interconnected entity. As particular mental processes, for example texting on a phone, are repeated, synaptic connections between the neurons involved in that mental process are strengthened, building units for memory and cognitive functioning. The notion that effective synapses thrive and inefficient synapses die away was a precursor to more recent work on *synaptic pruning* (Hong, Dissing-Olesen, & Stevens, 2016; Whalley, 2016) and research examining the long-term changes that occur at the synapse in response to input. In Hebb's honour, synapses that change as a result of input or experience are known as *Hebbian synapses* (Zenke, Gerstner, & Ganguli, 2017). Both past and current neuroscientists have focused attention on the Hebbian synapse and individual neural systems to better grasp the complex functioning of neural circuits as they relate to learning, memory, and behaviour (Dehorter et al., 2017; Yates, 2016).



David Scharf / Science Source

Neural network Neurons form circuits or networks that expand the communication among different brain regions. This image shows axons and dendrites (red) extending from the neuronal cell bodies (shown in blue).

Neuroplasticity

We now know that behaviour and experience can physically alter the brain. For example, children raised in homes where they learn both French and English have brains that are different (in terms of certain structures) from the brains of children raised in homes where they were exposed to only one language (Huttenlocher, 1994; Gibb & Kolb, 2018). The same is the case for children raised in homes where they were subject to neglect or abuse versus children raised in homes with nurturing and appropriately responsive parents (Cicchetti, 2012). The capacity of neurons and neural connections in the brain to reorganize in response to experiences or changes in the environment or to injury is generally referred to as **neuroplasticity** or neural plasticity (Carey et al., 2019; Morris, Rumsey, & Cuthbert, 2014). Plasticity refers to the brain's ability to form new neural connections when learning new tasks, or to repurpose neurons to take up functions lost through the death of other neurons (Kolb, 2018). There is evidence that some areas of the brain, including the hippocampus (Kempermann et al., 2018) and the olfactory bulb (Wu, Yu, & Komiyama, 2020), as well as the cerebellum (Bruchhage et al., 2020) and prefrontal cortex (Kolb, 2018; McEwen & Morrison, 2013), can generate new brain cells to replace lost cells, even into older adulthood (see Psychology Around Us 3.2). Plasticity at the synapse, such as the changes that occur from repeated release of neurotransmitters, is called *synaptic plasticity*. Neuroscientists are still in the early stages of understanding synaptic plasticity. One of the greatest challenges in neuroscience is to understand how changes in synaptic plasticity underlie our ability to change our behaviour, and adapt to new environments, over the entirety of our lifespans (Roelfsema & Holtmaat, 2018).

neuroplasticity the brain's ability to create new neural pathways as a result of experience or following an injury.

3.2 Psychology Around Us

The Long Reach of Neuroplasticity

Dr. Bryan Kolb, along with colleagues at the University of Lethbridge and around the world, has been studying how the brain changes, or exhibits neuroplasticity, in response to experience, neurological injury, drugs of abuse, and hormones for several decades. Dr. Kolb, along with Dr. Terry Robinson from the University of Michigan at Ann Arbor, were the first to show, in rats, that drugs of abuse such as amphetamine, cocaine, and morphine can lead to permanent changes in the strength of the connections between areas such as the nucleus accumbens and prefrontal cortex. The change in the strength of the neural connections between these two areas may be at the heart of drug addiction (Robinson & Kolb, 2004).

Since Dr. Kolb's early work, he has conducted more groundbreaking work showing that in rats the experiences of a father before he conceives offspring and of the mother during pregnancy, can alter the neuroplasticity and structure of neurons in their offspring. What is even more incredible is that the neuroplasticity of the offspring of the offspring of the mothers (grandchildren) can also be influenced by the environment their grandmothers grew up in. While it is easy to study multigenerational effects on neuroplasticity in rats, which only live for a few years, it

will take several decades, and generations, to figure out how the environment affects brain neuroplasticity in us, our children, and our grandchildren. This new and exciting subfield of neuroscience is called epigenetics. What we do know is that findings in this area of research may profoundly alter how we understand the influence of the experiences of one generation on neural processes—such as neuroplasticity, recovery from brain injury, and the effects of stress on brain function—on subsequent generations (Ambeskovic et al., 2019; Harker et al., 2015; Kolb et al., 2012; O'Donnell & Meaney, 2020).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

19. How do neurons work?

20. What happens in the axon of a neuron during an action potential?

21. When an action potential reaches the axon terminal, what happens?

22. How does a postsynaptic neuron receive and respond to messages from other neurons?

23. What is neuroplasticity and where in the brain is it commonly found?

What Do You Think? • Long axons are vulnerable to damage. What do you think some advantages might be of having a neuron with a very long axon (for example, one with a cell body in the spinal cord and axon terminal in the toe or finger)?

CNS Injury and Brain Lateralization

LEARNING OBJECTIVE 6

Explore the neuroscience findings regarding brain injury and the evidence for brain lateralization.

Main Types of Brain Injury

Our understanding of the central nervous system (CNS) and how it functions is often based on individual cases where something has gone wrong with the workings of the CNS. Typically, scientists divide CNS injury into two main categories: *traumatic brain injury* and *acquired brain injury*. Concussions (see Psychology Around Us 3.1), or blows to the head, and many spinal cord injuries are considered traumatic brain injuries—you were introduced to several examples of these earlier in this chapter. Infections, exposure to toxins, tumours, degenerative diseases, and strokes are considered acquired brain injuries. Recent research from the Toronto Rehabilitation Institute has found that the cost of these

injuries to the health care system is well over $30,000 in the first year post-injury per person, and similar costs often continue for years following injury or diagnosis (Chen et al., 2012). In this next section we will focus on CNS injuries that fall into the category of acquired brain injuries (see **Figure 3.16**) and follow this with a brief look at current treatment options for brain injury.

Infections and Toxins

If you think back to earlier in this chapter, you might remember that you were introduced to the blood-brain barrier (BBB). This barrier, made up of a covering of all of the blood vessels in the brain by astrocytic processes (feet), regulates what substances move in and out of the CNS. The BBB is critical for controlling glucose levels in the brain and the entrance of molecules and proteins that are necessary for the health of the brain and spinal cord into the CNS. It also plays a large role in keeping bacteria, viruses, and toxins out of the brain.

While the BBB typically does a great job, it is not perfect and CNS infections can happen. It is also possible for infections of the CNS to occur in the tissues, called the meninges (**Figure 3.17**), surrounding the brain and spinal cord. One example you may have heard of is meningitis. When a person has meningitis, they have a bacterial or viral infection in the space between the meninges and the top, or cortical areas, of the brain. Meningitis typically leads to inflammation of the membranes that surround the brain (van de Beek et al., 2016). If you have ever had an infection—your fingers or toes are areas where this commonly can occur—you may remember that the tissue surrounding it gets swollen and often painful. The swelling that is common with inflammation is a challenge when it happens around the brain. There is very little room between your skull and brain, so when inflammation and swelling occurs in the meninges, this can put a great deal of pressure on the brain itself and affect its ability to function. Viral infections are the most common causes of meningitis (Wright, Pinto, Palisoc, & Baghli, 2019), but it can be caused by bacterial and fungal infections as well. Symptoms typically include high fever, neck stiffness, headache with nausea and vomiting, difficulty concentrating, and in some cases a skin rash. Infants may exhibit constant crying, sluggishness, and poor feeding (Ku, Boggess, & Cohen-Wolkowiez, 2015). Seek medical care immediately if you, or someone you know, has these symptoms.

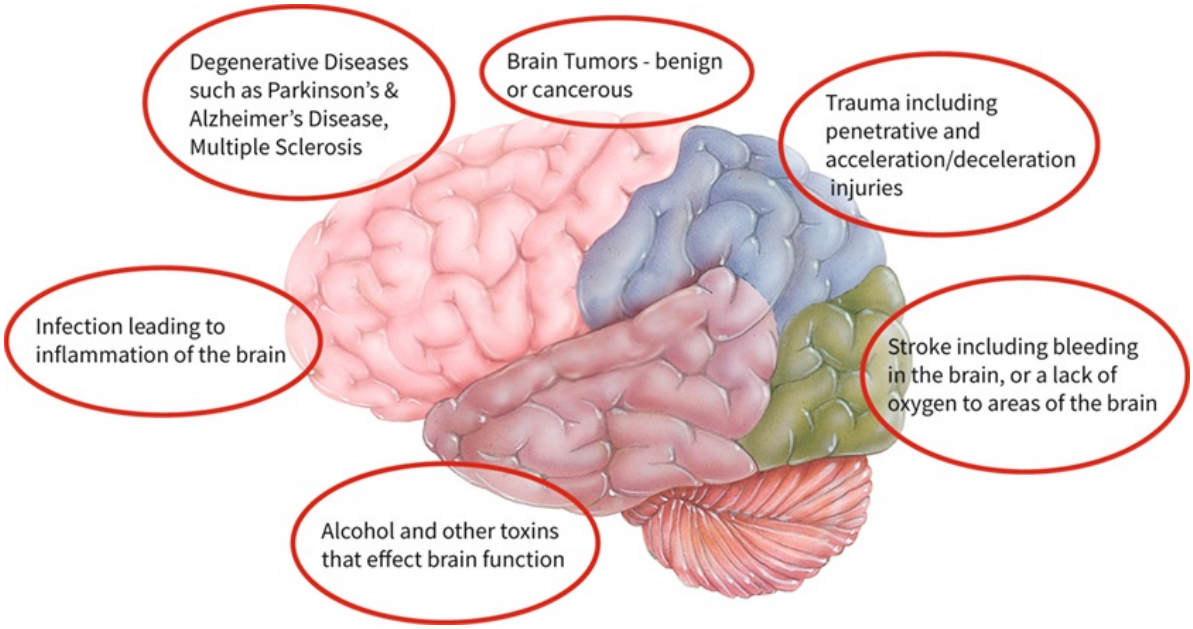
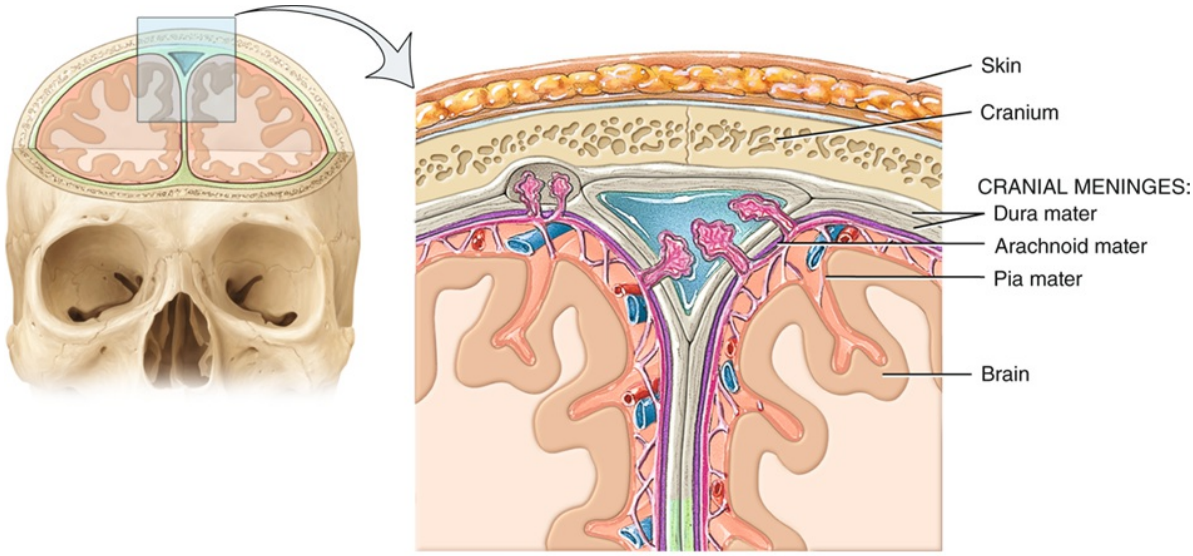


FIGURE 3.16 Main Sources of Acquired Brain Injury The brain can be injured, damaged or altered via many different events as shown in this diagram. All of these forms of brain injury can alter a person's behaviour directly after the event, as may be the case in infections, strokes or trauma, or may alter a person's behaviour slowly over time as in the case of degenderative diseases, brain tumors, and the effects of toxins.



The cranium and cranial meninges

FIGURE 3.17 Protective Features of the Brain The brain is protected by several features of our head including the skin, the cranium (often referred to as the skull), the three layers of the meninges which form a tough membrane that surrounds the brain and spinal cord, and our cerebrospinal fluid (which can be seen in blue in the dural venous sinus) which circulates around the brain. Reprinted with permission of John Wiley & Sons, Inc., from Derrickson B.H. (2019).

***Human physiology*. 2nd ed. Hoboken, NJ: J. Wiley.**

Toxins (and poisons) are substances that can pass through the BBB and cause damage or cell death to parts of the CNS. In Chapter 5 you will be introduced to visual pathways that are used to identify what an object is, and where it is, in our environments. The original research demonstrating that the brain has these two distinct pathways comes from the laboratory of Melvyn Goodale at Western University in Ontario after he worked with a woman who suffered carbon monoxide poisoning (a short-acting poison) that led to the loss of specific areas of her temporal lobes that are critical for object recognition (Goodale, 2011; Whitwell, Milner, & Goodale, 2014). Toxins that can affect the CNS come from a variety of sources, such as spiders, snakes, and frogs; chemicals in our environment, such as bisphenol A (BPA) which was used to create plastics such as water bottles, and toxins we ingest, such as alcohol (Filchakova, 2019; Osipov & Utkin, 2017; Santoro et al., 2019; Wilhelm & Guizzetti, 2016). These toxins may have relatively quick impacts on brain function (in the case of carbon monoxide and venoms) or their detrimental impact on the brain may occur over years and decades (in the case of BPA and alcohol). Many toxins have greater deleterious effects on the CNS early in development or in old age (Gupta, Gupta, & Shirasaka, 2016).

Degenerative Diseases/Disorders

Earlier in this chapter you were introduced (or re-introduced) to Michael J. Fox, who suffers from the degenerative disease called Parkinson's disease. This disease occurs when the dopamine-containing neurons of the substantia nigra die, leaving the individual with often severe movement impairments (Sveinbjornsdottir, 2016). Alzheimer's disease, which is in part due to the death of acetylcholine neurons at the bottom of the forebrain, leads to memory impairments (Guarino et al., 2019). A final example of a common degenerative disease is multiple sclerosis. In this case, the myelin sheath in the CNS degrades, leading to movement, speech, and sensory impairments (Dobson, & Giovannoni, 2019). All degenerative diseases are characterized by the loss, often slow, of functions that an individual was previously able to do, such as picking up a coffee cup, walking, or remembering the faces of family members.

Tumours

Brain tumours are due to the growth of a mass of abnormal cells within the CNS (de Robles et al., 2015). Like the rest of the body, some of these tumours can be cancerous (malignant) or noncancerous (benign). The effects of these tumours on behaviour can vary greatly depending on where the tumour is and how quickly it is growing (Leece et al., 2017). Tumours can cause a variety of changes in behaviours, including changes in movement, sensory abilities, speech, or personality. In Chapter 11, you will meet Elliot, who had a debilitating tumour in his prefrontal cortex. Removal of Elliot's tumour led to profound changes in his emotional and motivational states, his case caused a radical shift in the scientific community regarding the role of emotions in decision making. A tumour can be treated via surgery, or if it is inoperable, radiation or chemotherapy may be used.

Stroke

A stroke refers to damage to the brain from one of two causes: *ischemic stroke*, a loss of

oxygen to a particular brain area often due to a blockage in an artery, and *hemorrhagic stroke*, where an artery has broken, allowing blood to leak into an area of the brain. Strokes often lead to motor and sensory impairments on only one side of the body (the side opposite, or contralateral, to where the stroke occurred in the brain). Every year, roughly 2.5 percent of Canadians have a stroke and this percentage increases with age (Government of Canada, 2019). The five most common signs of stroke are sudden numbness or weakness on one side of the body, slurred speech, extreme headache, changes in vision, and sudden onset of cognitive confusion (Breedlove & Watson, 2020). Many of the individuals who suffer a stroke are left with lifelong deficits in sensory, movement, and/or cognitive function. Strokes are often preventable by maintaining a healthy lifestyle, which includes a healthy diet, exercise, not smoking, and controlling blood pressure (Government of Canada, 2019). New advances in the treatment of stroke, including drugs that can break up blockages in arteries, or surgery to stop bleeding in the brain, have greatly reduced the lifelong impact of strokes for many individuals (Lin, Finklestein, & Cramer, 2018). It is important if you, or someone you know, has the symptoms of a stroke to seek medical care quickly; many treatments are time sensitive (see Indigenous Experiences 3.1).

3.1 Indigenous Experiences

Social Factors That Impact Neurological Conditions for Indigenous Women

The diagnosis of a neurological condition, or brain injury, is traumatizing, both for the individual and for the family. However, such a condition is particularly devastating for Indigenous women, in part because the burden of caregiving in Indigenous communities often falls to women (Bourassa, Blind, Dietrich, & Oleson, 2015).

The colonial experience of Indigenous people in Canada, including residential schools and the Sixties Scoop (where welfare workers removed Indigenous children from their homes and placed them in non-Indigenous homes with foster and adoptive parents), not only undermined Indigenous culture, but it caused intergenerational trauma. This trauma continues to affect health outcomes in Indigenous communities and individuals today. As a result, Indigenous women are among the most marginalized people in Canada, and "these women experience multiple economic, social, and political barriers within and outside Aboriginal communities as a direct result of colonization" (Bourassa et al., 2015, p. 5). Forty-three percent of Indigenous women in Canada live in poverty. Indigenous women are more likely to have lower incomes, less education, inferior housing, higher rates of illness and chronic disease, and be a single parent, than Indigenous men. Indigenous women experience emotional abuse at higher rates than non-Indigenous women (Bourassa et al., 2015).

Carrie Bourassa at the First Nations University of Canada and her colleagues (2015) examined the impact of neurological conditions, and brain injury on Indigenous women and their families and communities and whether women could experience or provide safe and culturally appropriate care. Any condition impacting the brain, spinal cord, or nervous system was selected for inclusion in the review, including Alzheimer's disease and related dementias, amyotrophic lateral sclerosis, brain tumours, cerebral

palsy, dystonia, epilepsy, Huntington's disease, hydrocephalus, multiple sclerosis, muscular dystrophy, neurotrauma, Parkinson's disease, spinal bifida, and Tourette syndrome. A recurring theme was that Indigenous women faced difficulty in accessing culturally safe services in a timely manner, were apprehensive of health care providers, and experienced systemic racism, discrimination, and stereotyping—suggesting that Indigenous women often wait until a situation is dire before accessing care.

Indeed, Indigenous women reported being unlikely to seek support, citing rude and judgmental providers and stating that stereotyping was a factor that directly affected their health care. One woman said, "They say well, you Indians should—you guys should be out there working. You're able to work. I will not do this for you" (Bourassa et al., 2015, p. 11). In some areas, there are no formal services or supports available for Indigenous women with neurological conditions or for Indigenous women caring for others with neurological conditions, especially those specific to Indigenous cultures. And even when supports are available, some women report being traumatized by their interactions with the health care system. One said, "She kind of scared me – that's why I don't go and see my doctor anymore … I don't know, it's just the way her voice scared me inside, so I said, "That's it; I'm not going to see the doctor."" (p. 7). Another argued that they had to pull together as a community because not everyone in their communities had the strength to overcome their health challenges by seeking services, saying, "You know, some of us are stronger than others, some of us could've been sexually abused and hurt in a thousand ways and they seem to be able to function and learn and to grow. Others don't have that, you know, so why condemn them because they don't have that? Thank the Creator that some of us have the strength to help the ones that don't" (p. 13).

Ruslana Iurchenko/Shutterstock.com

Extremely vulnerable Indigenous women, those with a neurological condition or those caring for someone with a neurological condition, represent a marginalized population within an already marginalized population.

Bourassa and her co-researchers conclude, "… culturally safe care must be practiced;

racism, discrimination, and stereotyping must cease; respectful communication and dialogue between patients and healthcare providers must occur; stigmatizing patients must stop; and healthcare providers must learn more about the Aboriginal people they are caring for" (p. 16).

Critical Thinking Questions

What is one of the barriers that Indigenous women face when trying to access medical support for brain injuries or neurological conditions?

How does the intergenerational trauma experienced by Indigenous peoples affect their likelihood of trying to access medical care?

Can you think of ways to help lessen the trauma felt by some Indigenous women when trying to access health care?

Treatments for Brain Injury

There are many approaches for initial treatment of individuals who have suffered a brain injury. First and foremost, if someone has a brain injury, or suspects they are having difficulties with brain function, seeking early medical care is critical. Various drug cocktails can be given to help restore blood flow to oxygen-deprived areas, cooling of the brain and body can be used to reduce swelling, and treatments are available to prevent the neuronal loss that can often occur days and weeks later, around the edges of where an initial injury has occurred (Bogdanova, Yee, Ho, & Cicerone, 2016; Galgano et al., 2017). Other treatments for the longer-lasting effects of brain damage focus more heavily on behavioural therapies in the weeks and months after brain injury. Many of the current treatment modalities include movement-based therapies such as yoga (see photo), and cognitive rehabilitation strategies including the use of music to stimulate brain plasticity (see Positive Psychology 3.1) (Pfeiffer & Sabe, 2015; Silveira & Smart, 2020; Twyford & Watters, 2016).

Razoomanet/Shutterstock.com

Recovery from brain injury **Behavioural therapies such as yoga or drumming along**

with cognitive rehabilitation are often used to support recovery from acquired brain injuries such as stroke.

Differences in Brain Lateralization

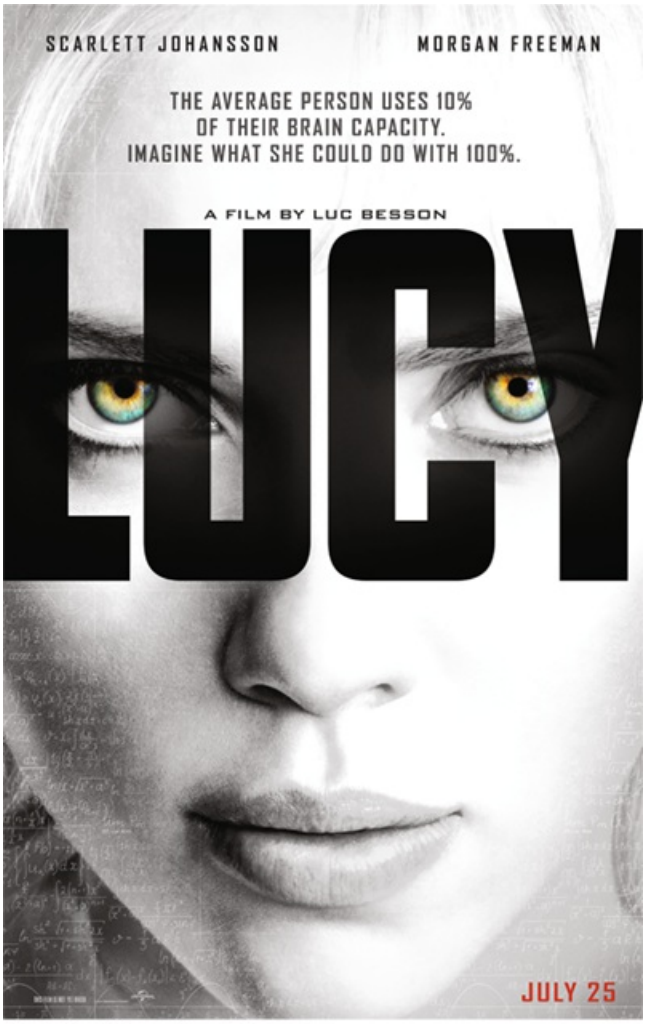
You may have heard popular theories about "left-brained" or "right-brained" types of people, or jokes about a person only using 10 percent of their brain (see Practically Speaking 3.1). Neuroscience tells us that, although the importance of such generalizations may be exaggerated in the public mind, there are, indeed, some differences among the brains of different groups of individuals. Much of the research in the area of hemispheric specialization has come from the study of *split-brain patients* (Bagcchi, 2016). These individuals have undergone neurosurgery to disconnect the two halves of the brain in order to treat severe epilepsy. An epileptic seizure is characterized by a spread of action potentials across the brain from one side to the other (see Your Brain and Behaviour 3.1 for further details). Severing one of the connections between the two halves of the brain may halt this spreading of neural activity and reduces the seizure severity. These split-brain patients have given us key insights into the workings of the brain and how the various parts of the brain communicate with one another.

3.1 Practically Speaking

Do We Really Only Use 10 Percent of Our Brains?

The idea that humans only use 10 percent of their brain is a common trope that's been around since at least the latter part of the 19th century (Jarrett, 2014). Harvard psychologist William James (and his understudy Boris Sidis) posited a version of this notion in the 1890s, suggesting that humans don't use the full potential of our large brains (Chew, 2018; James, 1907). Even in popular culture, this idea is regularly put forward in Hollywood movies. Films such as the 2014 *Lucy* starring Scarlett Johansson and the 2011 *Limitless* starring Bradley Cooper both exploit the 10 percent myth as the fundamental tenet of their plots. Unfortunately, this neuromyth (Bennett, 2015; Macdonald et al., 2017) is more suited to science fiction than reality. We do, in fact, use all of our brains, and while cognition can be improved upon in individuals, it is not because they are accessing previously unused parts of their brains, but rather they are making new connections between, or within, the various areas of the brain itself.

When thinking about the brain, we tend to consider brain usage in terms of what we are consciously thinking about or actively doing at the time. However, the brain is actually doing a great deal of subcortical work in the background, even when we sleep. These functions include hormone regulation, memory processing, pleasure, pain, experiencing emotions, and even the basic management of our body's orientation in space. Functions like breathing, holding ourselves upright, walking, or even fidgeting with a pen or pencil require brain activity that we may not be consciously aware of. Ultimately PET and fMRI studies that record brain metabolism show us that we do, in fact, use all of our brains most of the time, although during different tasks we use more of certain parts of the brain than others. Ultimately and maybe even sadly, there's no reservoir of unused brain power that we can magically unlock to propel us toward genius. The take-home message: beware of neuromyths!



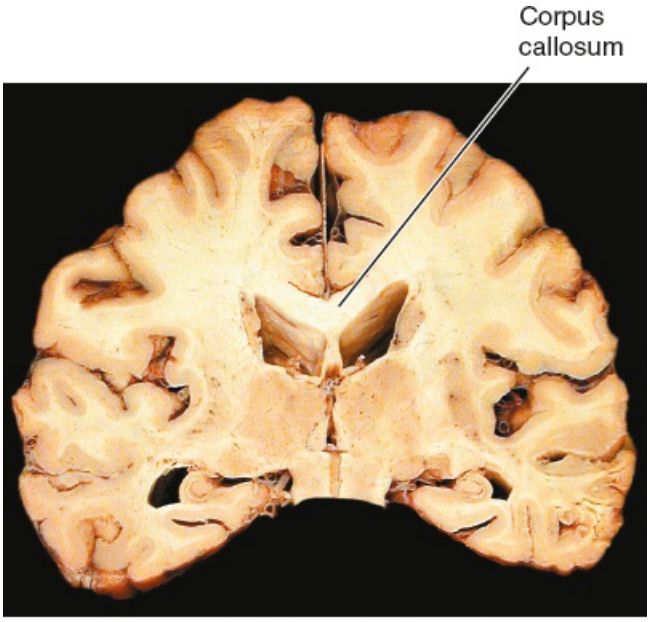
AF archive/Alamy Stock Photo

Neuromyths in movies **The 2014 science fiction movie Lucy starring Scarlett Johansson capitalized on the myth that we use only 10% of our brain.**

Communication from one side of the cortex to the other occurs via a dense bundle of neural fibres (axons) that make up a large structure called the **corpus callosum**, shown in **Figure 3.18**. The corpus callosum connects the two **hemispheres**. As previously noted, each hemisphere controls the movement of, and receives information from, the opposite side of the body.

corpus callosum bundle of axons that allows communication from one side of the cortex to the other.

hemispheres two sides of the brain.



Source: Mark Nielsen

FIGURE 3.18 The corpus callosum This cross-section of the human brain shows the large bundle of axons that allows communication between the two hemispheres.

In most people, cortical areas specialized for language exist only on one side of the brain. Wernicke's and Broca's areas, related to speech and language, for example, are on the left side of most people's brains—but not everybody's. The exceptions occur most often in left-handed individuals. Some left-handers (about 18 percent) (Springer & Deutsch, 1993) have language areas located on the right side of their brains, or on both sides.

In 1981, Roger Sperry won the Nobel Prize in Physiology or Medicine (shared with David Hubel and Torsten Wiesel) for his work on brain lateralization. He and his colleague Michael Gazzaniga (Sperry, Gazzaniga, & Bogen, 1969) designed a number of study techniques that allowed them to examine the functioning of the hemispheres of *split-brain patients*. Split-brain patients are individuals who have had their corpus callosum severed to stop the spread of seizures from one side of the brain to the other. Following the surgery, these patients lack the ability to integrate information from the two hemispheres (Gazzaniga, 2005, 2009). Studies on these patients highlight the fact that the two hemispheres need the corpus callosum to communicate. Although split-brain patients are largely unaffected by the surgery in their day-to-day lives, the results of split-brain studies clearly show the hemispheric localization of a number of perceptual and cognitive functions.

For example, as illustrated in **Figure 3.19**, suppose a split-brain patient is given a pencil to hold in his left hand under a table where he cannot see it; a divider is placed beneath the table so that he cannot pass the pencil to his right hand. (Remember that tactile and visual information cross from one side of the body to the opposite side of the brain for processing, so that information gathered by touch on the left side of the body or visually from the left visual field is sent first to the right hemisphere of the brain for processing.) If a person's corpus callosum is intact, then information from either side of the body is almost immediately shared with both hemispheres. But in split-brained patients this is not the

case; information received by only one side, in this case the left side, of the body goes only to the opposite hemisphere of the brain, or in this case the right side.

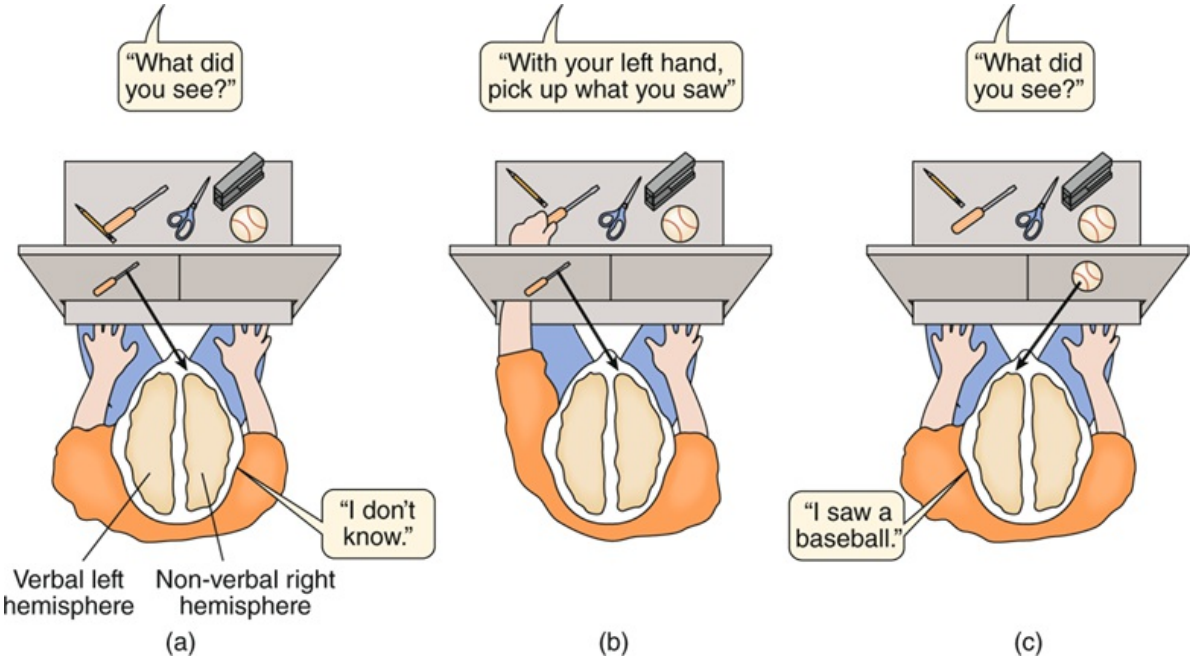


FIGURE 3.19 Split-brain research (a) When a picture of a screwdriver is flashed to a split-brain patient's left visual field, the information goes to his non-verbal right hemisphere and he cannot name the object. (b) When instructed to use his left hand (controlled by his right hemisphere) to feel behind a screen among a variety of objects and select the one that matches the picture just seen, the patient correctly selects the screwdriver. (c) When a picture of a baseball is flashed to the patient's right visual field, he easily names it.

If we asked this patient what he had held in his left hand, do you think he could tell us in words? Remember that the language production area (Broca's area) is located in the left hemisphere of the brain and for information from the right side of the cortex to pass over to the left side of the cortex, you need an intact corpus callosum. Thus the correct answer is no, he could not verbally tell us what had been in his hand because his left hemisphere did not receive the tactile pencil information. If shown a set of pictures, however, he could use his left hand to point to a picture of a pencil. He could do this because his left hand is controlled by his right hemisphere; therefore, tactile information about the pencil would go to his right hemisphere and he would then be able to use his left hand to identify the object. That is, he (or at least his right hemisphere!) knows what the object is, but cannot say it.

Although split-brained patients show processing problems under very artificial laboratory conditions, they show very few problems overall. This is because in their real-world interactions, both sides of the brain receive almost exactly the same information (Kozlovskiy et al., 2012).

In addition to these rather clear-cut functional and anatomical asymmetries, many people believe that more general thought processes are lateralized, such that people who think a certain way use proportionately more of one side of their brain than the other side. For

example, the right hemisphere of the brain is thought by some to be dominant in artists and engineers. By contrast, the left hemisphere of the brain is thought to be dominant in individuals with strong analytical and verbal skills.

What then is the scientific evidence for "right-brain" dominant and "left-brain" dominant thinking? Certainly the work with split-brained patients shows that there is, indeed, some localization of function in one or the other of our hemispheres. However, the possibility that one side of our brain is in charge and dominates the functioning of the other side of our brain is not supported by neuroscientific research. Since the corpus callosum allows for virtually instant communication from one side of the brain to the other, it means that, in everything we do, both sides of the brain are involved (Nielsen et al., 2013; Sears, 2016).

Overall, the research shows that, aside from the language areas noted previously, the two hemispheres are more similar than they are different. Indeed, even when right–left differences are detected in function, these differences are usually relative. For example, the left brain can accomplish what the right brain can accomplish, it's just less efficient at some tasks and more efficient at others.

The Integrated Brain

It's important to remember that many of the previously mentioned brain areas, including the cortical regions, can be subdivided into multiple areas or nuclei, each of which is involved in different functions. However, no brain region works alone. To process information, integrate it with previous information, and then formulate and execute a behavioural reaction requires neural circuitry rarely contained within a single brain region. Understanding how a brain region works requires sophisticated knowledge about information that flows into and out of the area, and of course, the important computations that occur within the neurons of that given brain region.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

24. What treatments are currently being explored to treat central nervous system injuries?

25. What are the different categories of brain injury? Are they mutually exclusive?

26. What is the difference between a hemorrhagic and ischemic stroke?

27. Why is the study of neuroplasticity important?

28. What does research show about "right-brained" thinking versus "left-brained" thinking?

29. On which side of the brain do most people have their language-related areas? What about left-handed people?

What Do You Think? • What are some of the ethical problems associated with searching for structural differences in the brains of different groups of people?

Evolution and the Nervous System

LEARNING OBJECTIVE 7

Describe the basic theory of evolution and explain how it has influenced our understanding of the human nervous system and the evolution of the human brain.

So where did our nervous system and ultimately our brain come from? The only way to understand the current form of our nervous system is to go back in time millions of years and look at the structure of the nervous systems of the first animals that lived on Earth. Finding physical evidence to examine is difficult, though, because soft tissue doesn't typically **fossilize**. We know that life has existed on Earth for several billions of years, but the oldest preserved nervous system tissue we have is from a shrimp-like organism that lived around 520 million years ago (Yang et al., 2016). The oldest preserved animal brain is from a dinosaur-like animal that lived about 130 million years ago (Brasier et al., 2016) and the oldest preserved human brain, the Heslington Brain found in a peat bog in England in 2008, is only 2600 years old (see photo).

fossilize the geological process of turning biological material into stone.

Sonia O'Connor, Esam Ali, Salim Al-Sabah, Danish Anwar, et al. Exceptional preservation of a prehistoric human brain from Heslington, Yorkshire, UK. *Journal of Archaeological Science*, Vol. 38, Issue 7, 2011, pp. 1641–1654. DOI: 10.1016/j.jas.2011.02.030

Peat bog preservation **This brain is an example of a peat bog-preserved brain. It**

shows the Heslington Brain found in 2008 in England.

What we do have are skeletal fossils, without preserved soft tissue, from animals and many human species that give us clues to what our soft brain tissue and nervous systems were like, and how the bodies of our ancestors have changed over time. To understand how evolutionary processes have influenced the development of our present-day human form and behaviour, we need to be aware of how animal life evolved over the billions of years that living organisms have existed on Earth. We all originated from a **common ancestor** through a biological process called **evolution** (Dawkins & Wong, 2010). In order to appreciate how our evolutionary past has shaped our nervous system and the behaviours we express today, we will step back and briefly review the geological age of Earth, the theory of evolution, and what we know of the evolution of animal life. We will end with a look at the evolution of the human brain and behaviour. The discussion of evolution and its relation to our behaviour is studied by a field called **evolutionary psychology** and will be revisited in upcoming chapters.

common ancestor an organism that is common to the evolutionary history of two or more living species.

evolution a process of change over time.

evolutionary psychology field of study that examines how the process of evolution has shaped the body and brain via the interaction of our genes and the environment to produce our thoughts and behaviours.

The Age of Earth

Current estimates place the age of Earth at around 4.55 billion years (Dawkins & Wong, 2010). The first fossilized evidence of life has been dated to approximately one billion years after the formation of Earth. Fossil evidence of multicellular organisms suggests they evolved around 1.8 bya (billion years ago). However, it isn't until somewhere between 600 to 500 mya (million years ago) that we see an explosion in the variety of plants and animals on Earth (Zimmer, 2009). Pause and think for a minute. The average life expectancy for humans is approximately 82 years. This is only 0.00000001% of the total time that life has existed on Earth. So while we measure our lifetimes in decades of years, we measure the evolution of life on this planet in millions and billions of years. To truly understand the evolution of life on Earth, you need to think in geological time, not human time.

The Theory of Evolution and the Organization of Life

The theory of evolution puts forward that all life on Earth is interrelated and derives from one common ancestor, also referred to as LUCA (last universal common ancestor). We can trace the **phylogeny**, or evolutionary history, of all life on the planet from this original common ancestor. As time progressed, those animals that survived and reproduced passed on their traits via their genetic material to their offspring; those that did not pass on their genetic material did not contribute their unique physiology and behaviour to future generations. Over millions of years, the process of evolution shaped the development of *chordates* (about 450 mya), which had large nerves that ran just below the surface of their

backs (also called the dorsal surface), then *vertebrates* (about 425 mya), which had a bony structure protecting the dorsal nerve cords. *Amphibians* (about 400 mya) were the first creatures to move onto land because of the emergence of structures such as air-breathing lungs and legs to move around on. *Reptiles* (about 300 mya) had new adaptive traits that allowed them to move even farther away from the water, such as thick skin that prevented dehydration and the ability to lay shell-covered eggs that could survive out of water. About 180 mya, *mammals* evolved from an offshoot of reptiles. Mammals are differentiated by the ability of females to keep their eggs inside their bodies and gestate their young internally, and also the ability to nurse their young with milk produced by mammary glands (hence the name *mammals*).

phylogeny the development of unique species over time.

At present all life forms, current or extinct, are classified into one of three super kingdoms: Eucharia, Archea, or Bacteria (Woese, Kandler, & Wheelis, 1990). Each super kingdom is further broken down into smaller kingdoms of living things; for instance, human beings fit into the kingdom Animalia, which is part of the super kingdom Eucharia (**Figure 3.20**). The Animalia kingdom is unique because it is the only division of life that contains organisms with nervous systems. While it may seem that plants and animals are the most prevalent life forms on Earth, there are a huge number that you can't see, such as bacteria. In reality, plants and animals represent only a small fraction of the types and numbers of organisms that live on the planet.

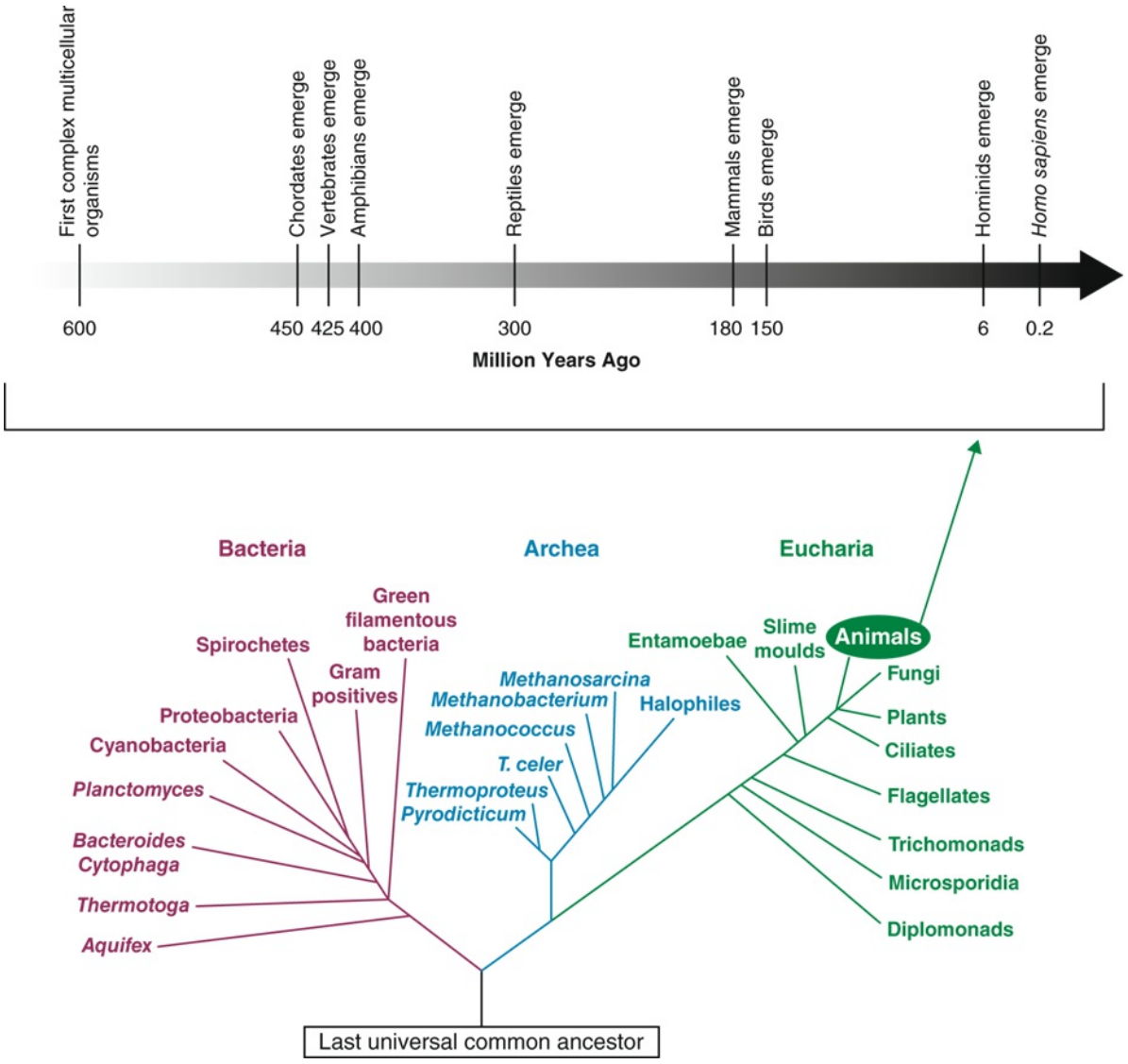


FIGURE 3.20 The universal tree of life and a timeline of evolution This figure shows the overall relationship of the three domains to the kingdoms in which life is organized. The timeline shows the evolutionary history of animals; *Homo sapiens* come from the Hominid line and have been in existence for only a short period of time (approximately 200,000 years).

Within the kingdom Animalia, fossil evidence suggests that the evolution of complex multicellular organisms originated about 600 mya during the Cambrian explosion. After this event chordates evolved, followed by vertebrates, amphibians, reptiles, mammals, birds, and ultimately hominids or humans, which we are part of as the *Homo sapiens* species. How do these various groups in the kingdom Animalia differ? Several adaptations have occurred over the last 600 million years that have been essential to the evolution of our species into its current form.

Chordates (pronounced "KOR-dates") first appeared about 450 mya. What made these animals distinct from previously living multicellular organisms were the large nerves running just below the surface of their back (also called the dorsal surface). These large

dorsal nerve cords were the communication system of the central nervous system with the rest of the body or peripheral nervous system (see photo).

topimages/Shutterstock.com

Vertebrates Fish species are a typical example of vertebrates. In vertebrates, the spinal cord is surrounded by the bones or vertebrae that make up the spinal column. These bones protect the spinal cord from damage.

Vertebrates (pronounced "VERT-eh-brates") evolved about 25 million years after the chordates (see photos). The dorsal nerve cords can be easily damaged and protection for these nerve cords with the bones of the spinal column was a distinct advantage. As humans we have vertebrae that make up the bones of the spinal column that protects our spinal cord. Currently there are several classes of fish, amphibians, reptiles, birds, and mammals that are considered vertebrates.

WaterFrame_fba/Alamy Stock Photo

Vertebrates Whales are another example of a vertebrate animal.

Amphibians, which currently includes animals such as salamanders, frogs (see photo), and toads, can be dated back to about 400 mya, according to fossil evidence. The advantage that amphibians had over prior species was the ability, as adults, to live on land due to the emergence of structures such as air-breathing lungs and legs that allowed for mobility on land. While having vertebrae to protect the dorsal nerve cords is an important advantage for survival, before we can begin to discuss animals that live on land we have to get on land!

BIOSPHOTO/Alamy Stock Photo

Amphibians Amphibians such as frogs have the ability to live on both land and in water. This allows them to take advantage of both environments for survival.

Reptiles, which emerged about 300 mya, had other adaptive traits that made them more suitable for living on land farther away from water. If you think of contemporary reptiles, snakes, lizards, and turtles (see photo), they have thick skins that can prevent dehydration and can lay shell-covered eggs, which means they no longer are dependent on water as a place to leave their eggs and hopefully successors.

Mammals evolved about 180 mya from an offshoot of the reptile line (Dawkins & Wong, 2010). Mammals differ from their reptilian ancestors in several ways. First, mammals no longer laid eggs but began to gestate their young internally. This was advantageous because it provided a level of security that reptiles that lay their eggs to hatch did not have. Second, mammals nurse their young using milk produced by mammary glands. Interestingly, we still have two species of animals that are a combination of these traits. In Australia, the duck-billed platypus (see photo) and echidna both lay eggs but nurse their young.

Characteristics that are similar between animal species and that can be traced back to a common ancestor are referred to as **homologous** and the traits that have evolved independently in different species are called **analogous**. For example, having offspring develop from an egg-like form is common to all animal species and therefore is a homologous trait. The way to determine if a physical adaptation or behavioural trait is homologous or analogous is to do a comparative analysis between species and to determine whether animals that have the same traits can be linked to a common ancestor. The process of analogous evolution leading to similar adaptations without a common ancestor is called **convergent evolution**. For example, birds and bees both have wings, but when you trace their ancestral tree they do not have a common ancestor that had wings. Thus, the evolution of wings has happened at least twice in two different species, making it an example of an analogous process leading to similar adaptations in distinct species. People have been working on and thinking about the idea of evolution for centuries, but the theory of evolution as we know it today is relatively new (Mayr, 2014, 2001).

homologous characteristics that are similar between species and that can be traced back to a common ancestor.

analogous characteristics that are similar between species and that *cannot* be traced back to a common ancestor.

convergent evolution the development of similar physical characteristics or behaviours in different species that do not share a common ancestor; occurs because of exposure to similar environmental conditions for different species.

Richard Whitcombe/Shutterstock.com

Reptiles Many reptiles live in water but can also live on land. Turtles and alligators are good examples. These animals have thick skins that prevent dehydration when they are on land.

Charles Darwin's famous book *On the Origin of Species* (1859), which shifted scientific attention toward human origins, was only published about 160 years ago. For many years, however, biologists had been studying fossilized remains and noticing differences among similar species over time. In addition, many of Darwin's scientific contemporaries, specifically Arthur Wallace, were also putting together the fundamentals of the theory of evolution. What set Darwin apart was the enormous amount of work he conducted describing differences between species and how changes in the environment could influence which individuals within a species would survive and reproduce. Much of this work came from the year trip Darwin took on the HMS Beagle (1831–36), which sailed from England to South America, Australia, and South Africa. Darwin, who was hired as the ship's botanist at the last minute, made critical observations supported by copious notes and dozens of animal specimens that he brought back from the journey (Hergenhahn & Henley, 2013). As an interesting side note, Darwin came close to not being hired as the HMS Beagle's botanist because the captain didn't like the shape of his nose. During the early 1800s, it was thought that you could determine the characteristics of a person's personality by assessing the bumps on their skull (phrenology) and from the shape of their face (physiognomy). Both of these avenues of science have since been proven to have no validity.

worldswildlifewonders/Shutterstock.com

Mammals A platypus is an interesting example of a mammal that has retained traits of reptiles but has developed traits of mammals. They lay eggs like a reptile but nurse their young like mammals.

From the specimens he gathered, Darwin began to realize that the process of change in a specific species over generations was likely due to how well a particular animal adapted to the environment it lived in. The animals with physical and behavioural attributes that were well suited to their environment were more likely to survive, reproduce, and pass on their traits to their offspring. He called this process **evolution by natural selection**, which is influenced by an individual's **fitness**, or ability to survive and reproduce in a given environment. Genetic inheritance and the process of evolution is something many people take advantage of today by breeding specific animals to enhance the development of specific traits. For example, dog breeders will breed specific dogs to end up with offspring that are bigger, faster, meaner, or cuter than the parents.

evolution by natural selection the differential likelihood between members of a species in their ability to survive and reproduce.

fitness the ability of an individual to successfully grow to maturity and have offspring that perpetuate the existence of the species that the individual belongs to.

Darwin made four critical observations to explain the diversity of life on the planet:

As more and more fossil evidence became available, Darwin realized that there were subtle changes in the forms of animals that were fossilized. That is, animals were changing over large scales of time.

Aspects of species that seem different on the surface, such as a human hand, a bat's wing, and a cat's paw, had structural similarities underneath. For all three of these animals, the number and arrangement of the bones under the skin, while different sizes, are the same (**Figure 3.21**).

Selective breeding of captive animals leads to changes in the appearance of the animal in question.

Not all animals that are born will survive to maturity and reproduce.

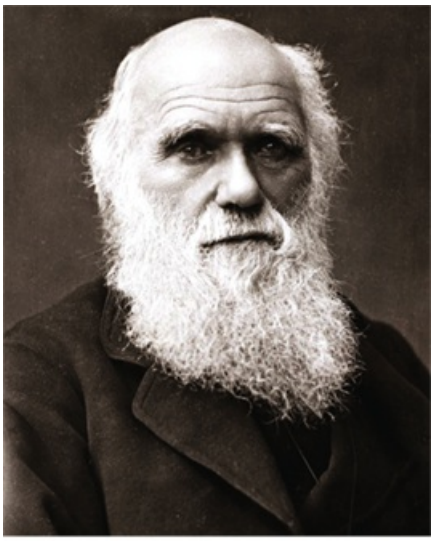
In addition to these four observations, Darwin made a fundamental inference from his observations: animals of a given species that will survive and reproduce are those that can adapt and therefore survive best in their current environment. These individuals are considered to be the fittest members of their species. (Note that the phrase "survival of the fittest," which was coined by sociologist Herbert Spencer, is not completely accurate because it implies some level of perfection in an individual that is able to survive and reproduce. "Survival of the fit enough" would be a more accurate phrase.) Thus, as the environment changes, the organisms that successfully live in that environment will also change, and these changes will be passed on to their offspring. Therefore, over generations, shifts in the physical and behavioural aspects of a species will occur if the environmental pressures are such that certain variations of an animal, for example longer necks in giraffes, are more likely to survive and reproduce than others. Wrists are another example of the evolution of a trait that was critical to the survival of land-based animals, as shown by the discovery in Nunavut of an animal named Tiktaalik (see photo).

Courtesy of the University of Chicago

The missing link **For many years, one of the criticisms of evolutionary theory was the lack of fossil evidence of a transitionary animal; that is, how did fins, which aren't very well suited for moving around on land, evolve into arms or legs? In 2005–2006, Neil Shubin and colleagues discovered the missing link—a fish in the Canadian Arctic (dated around 375 million years ago) that had a primitive wrist with finger-like bones. The Nunavut Council of Elders were consulted as to what to call this species, and it was named *Tiktaalik*, an Inuit word meaning freshwater fish (Shubin, 2008).**

Therefore, over generations, shifts in the physical and behavioural aspects of a species will occur. Canadian researcher Bill Cade, who worked at the University of Lethbridge, is studying aspects of this evolutionary process in *Teleogryllus oceanicus* crickets (Logue et

al., 2010). The male of this species sings to attract mates, but their song also attracts parasitic flies that lay their eggs on the cricket. After the eggs of the fly hatch, the young flies use the cricket as their food source. Over generations, the crickets that are quieter have preferentially survived, and now this is a species with a significant proportion of silent male crickets. The implications of the loss of song on the long-term survival of this cricket species are still unknown, but research to answer this question is underway (Simmons, Tinghitella, & Zuk, 2010; Tinghitella & Zuk, 2009). Darwin (see photo) did not know about the underlying genetic processes that led to the inheritance of traits between generations. Although he speculated about the existence of genes (which he called *gemmules*), he had no evidence for their existence. It wasn't until many decades later that Darwin's theory of evolution was integrated with Gregor Mendel's discovery of genetic processes. The initial integration of our knowledge of genetics and evolution occurred in the early 1920s and is now known as the *modern synthesis* (Mayr, 2014).



Bob Thomas/Popperfoto/Getty Images

Charles Darwin, the father of evolution **Darwin's extensive cataloguing of various life forms he encountered during his voyage on the HMS Beagle led to his famous book, *On the Origin of Species*, and to scientific acceptance of the theory of evolution.**

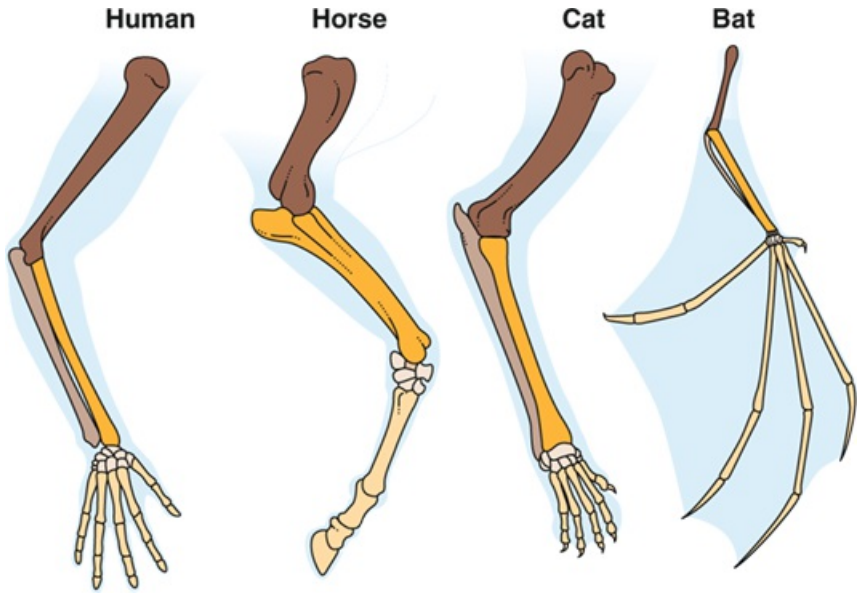


FIGURE 3.21 Comparative anatomy Similarities among organisms demonstrate how they are related. These similarities among four vertebrate limbs illustrate that, while proportions of bones have changed in relation to each organism's way of life, the forelimbs have the same basic bone structure. Notice that the number of "fingers" on the human hand, cat paw, and bat wing are the same on all three.

It is important to remember that the process of evolution never stops. All living things continue to evolve today in response to changes in the environment. A present-day example of this is antibiotic-resistant bacteria. Recently in the United States it was reported that an individual died from a bacterial infection that could not be treated by any of the antibiotics we currently have available. The bacteria that are antibiotic resistant survived, changed, and reproduced to become impervious to the effects of antibiotics. Ultimately, there are no perfect animals. Animals that can survive and reproduce in the environment they currently live in succeed but only as long as the environment they are in doesn't change. This is true for *all* animals, including humans. If our environment changed drastically tomorrow—if, say, an asteroid were to hit Earth or a super volcano were to explode—we might not have the tools or resources to survive the dramatic change in the environment. Remember, as *Homo sapiens* we have only been around for a blink of the geological eye. Our species has been around for about 200,000 years, compared with the history of life on Earth, which is measured in billions of years. There is no guarantee that we will be around in the long term, especially from the perspective of geological time.

The Evolution of the Brain

Scientists today do not see humans as the pinnacle of life on Earth, but rather as one species out of many that has adapted to fit a particular (and admittedly very broad) niche. The evolution of our species has led to some noticeable differences between us and other species on Earth—most notably in the development of our nervous system, of which our brain is a part. One way to understand how the human brain has evolved differently from that of other animals is to compare the difference in the size of our brain relative to the brain size of other organisms. Clearly we're not referring to simple volume and weight

comparisons—by these measurements, the brain of an elephant will beat out a human brain every time. To compare the overall size of the brain between species, it is more appropriate to discuss the ratio of brain weight to body weight for the animal in question. What specifically sets apart the brains of primates relative to other species is the size of the cortex. For most primates it is the largest part of the brain, taking up about 50 percent of the brain. For modern humans this number is even larger, with about 80 percent of our brain consisting of the cortex (Mai, Majtanik, & Paxinos, 2015). It would be wonderful to actually be able to study and dissect the brains of our extinct ancestors, but as mentioned earlier, tissue doesn't fossilize well. But fossilized skulls, from which we can make a cast—specifically an endocast, which is a cast of the inside of a hollow object of the brain that would have been inside a particular skull—tells us that brain size has increased significantly in human species (Hominids).

To give you an example of these differences in skull size, compare the skull of an Australopithecus (which became extinct about 2 mya) to that of a *Homo sapiens* in **Figure 3.22**. The first major difference you can see is that the overall size of the Australopithecus skull is much smaller. Scientists estimate that the Australopithecus brain was about the size of a current chimpanzee brain (Carlson et al., 2016), which is about one third the size of a *Homo sapiens* brain. (That being said, the Australopithecus were quite successful as a species and existed for about 2 million years before going extinct.)

Michael Nicholson/Getty Images Derrick Neill/123RF

FIGURE 3.22 Skull size The Australopithecus skull (a) is not only smaller in size than the present-day human skull (b), but it has a much smaller frontal area, which leads to the assumption that the frontal cortex in the Australopithecus was also smaller.

Finally, look at the shape of the skull as well as its size. The area at the front of the skull has expanded in modern *Homo sapiens*, which implies that the area underneath, presumably the frontal cortex, has expanded as well. This expansion of the cortex in modern humans has been essential to the development of many of the social and technological advancements we have made as a species. While we cannot easily go back and look at the environmental events that have shaped the development of the modern human brain, specifically the expansion of the cortex, many theories have been proposed, including the development of complex societies (Dunbar, 2014), tool use, and language development (Stout & Chaminade, 2012).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

30. Describe the evolutionary differences between chordates, vertebrates, amphibians, reptiles, and mammals.

31. What are Darwin's four observations and one inference, and how are they important for our understanding of how to breed domestic animals, such as cats, dogs, and dairy cows, for specific traits?

32. Describe how brain and skull size in humans has changed over our evolutionary history.

What Do You Think? • Given the information you now have on the process of evolution, what areas of human behaviour do you think should/could be studied from an evolutionary perspective? How could this be accomplished?

Summary

How Do Scientists Study the Nervous System?

LEARNING OBJECTIVE 1 Understand the key methods that scientists use to learn about nervous system anatomy and functioning.

Neuroscientists examine autopsy tissue and patients with localized brain damage to learn about brain anatomy and brain function.

EEGs and neuroimaging, such as PET scans and fMRI, allow scientists to study brain function in the living brain.

How Is the Nervous System Organized?

LEARNING OBJECTIVE 2 Name and describe the functions and subdivisions of the two major parts of the nervous system and become familiar with current research in spinal cord injury.

The two major divisions of the nervous system are the central nervous system, which consists of the brain and spinal cord, and the peripheral nervous system, which consists of nerves that extend throughout the body outside the central nervous system.

The peripheral nervous system has two divisions: the somatic nervous system, which sends information about the senses and movement, and the autonomic nervous system, which controls involuntary functions and responses to stress.

The autonomic nervous system is divided into the sympathetic "fight-or-flight" nervous system, which responds to stress by activating the autonomic system.

The parasympathetic "rest and digest" nervous system is responsible for returning the

autonomic system to baseline.

The spinal cord provides the interface between the CNS and PNS controlling basic reflexes and the passage of information about sensation and movement from the brain to the body and back again.

Structures of the Brain

LEARNING OBJECTIVE 3 List key structures of the brain and describe their relationships to our behaviour.

The brain can be subdivided into many regions, each of which serves one or more specialized functions.

The brainstem participates in movement and sensation of the head and neck as well as in basic bodily functions, such as respiration and heart rate.

The midbrain includes the substantia nigra, an area important for movement.

The hypothalamus controls basic drives (food, drink, sex) and hormones, while the thalamus serves as a relay station for sensory information on its way to the cerebral cortex.

Many brain regions participate in different types of learning— the hippocampus is important for spatial navigation learning and learning about life's events, the amygdala is important for fear learning, the cerebellum and striatum are important for motor learning, and the nucleus accumbens is important for reward learning.

A large part of the brain consists of the cerebral cortex. The cerebral cortex can be subdivided into frontal, parietal, temporal, and occipital lobes. The cortex controls movement, integrates sensory information, and serves numerous cognitive functions.

How Does the Nervous System Work?

LEARNING OBJECTIVE 4 Describe the two major types of cells in the nervous system and describe the primary functions of each.

The two major types of brain cells are neurons and glia.

Neurons communicate with other cells by producing and sending electrochemical signals.

Glia are involved in various functions, such as forming the blood–brain barrier, producing myelin, and clearing the brain of debris.

How Do Neurons Work?

LEARNING OBJECTIVE 5 Describe what happens when a neuron "fires" and how neurons communicate with one another to produce behaviour, become familiar with neural networks and neuroplasticity.

Action potentials are generated within a neuron by the flow of ions, specifically sodium and potassium, across the cell membrane. The generation of action potentials within a neuron facilitate communication between neurons, which occurs at the

synapse via chemical signals called neurotransmitters.

Neurotransmitters are released by the presynaptic neuron, diffuse across the synapse, and bind to receptors on the postsynaptic site.

Action potentials travel faster down myelinated than unmyelinated axons.

CNS Injury and Brain Lateralization

LEARNING OBJECTIVE 6 Explore the neuroscience findings regarding brain injury and the evidence for brain lateralization.

Brain injury can be categorized as traumatic or acquired.

Research shows that the two hemispheres are more similar than different and that any differences are usually relative.

Acquired brain injury is typically categorized into damage by infection or toxins, degenerative diseases, tumours, and strokes.

Evolution and the Nervous System

LEARNING OBJECTIVE 7 Describe the basic theory of evolution and explain how it has influenced our understanding of the human nervous system and the evolution of the human brain.

All life on Earth is interrelated and derives from one common ancestor through a process known as evolution.

An organism's ability to survive and reproduce (thereby transferring their traits to their offspring) is referred to as the individual's *fitness*.

The brains of modern-day humans are much larger than most other animal species or of Hominid species that have gone extinct.

Key Terms

absolute refractory period

action potential

afferent neurons

amygdala

analogous

association cortex

autonomic nervous system

axon

axon terminal

Broca's area

cerebellum
cerebral cortex
common ancestor
concentration gradients
convergent evolution
corpus callosum
dendrites
depolarization
dopamine
efferent neurons
electrostatic pressure
endocrine system
evolution
evolution by natural selection
evolutionary psychology
fitness
fossilize
frontal lobe
glia
hemispheres
hindbrain
hippocampus
homologous
hyperpolarization
hypothalamus
interneurons
ion channels
limbic system
medulla
myelin
neuroimaging
neurons
neuroplasticity

neuroscience
neurotransmitter receptors
neurotransmitters
norepinephrine
nucleus accumbens
occipital lobe
parasympathetic nervous system
parietal lobe
phylogeny
pituitary gland
pons
postsynaptic potentials
prefrontal lobe
relative refractory period
resting potential
reticular formation
sodium-potassium pump
somatic nervous system
somatosensory strip
spinal cord
substantia nigra
sympathetic nervous system
synapses
synaptic vesicles
temporal lobe
thalamus
threshold
Wernicke's area

Self-Study Questions

Multiple Choice

1. What can neuropsychologists learn about the brain from studying patients with brain

damage?

a. They can identify the cause of the brain damage.

b. They can see the connections between brain regions.

c. They can hypothesize what the brain region does when undamaged.

d. They can detect changes in blood flow within the brain.

2. Neuroimaging techniques such as PET scans and fMRI enable researchers to:

a. examine brain cells microscopically.

b. see what parts of the brain are active during certain tasks.

c. summarize activity over a large expanse of tissue.

d. record brain waves from the surface of the scalp.

3. Semi-permeable membrane and sodium-potassium pumps are responsible for

a. the unequal distribution of charges across the cell membrane.

b. the equal distribution of charges across the cell membrane.

c. graded action potentials.

d. non-graded action potentials.

4. The central nervous system consists of

a. all nerve cells in the body.

b. the brain and spinal cord.

c. the somatic and autonomic nervous system.

d. the sympathetic and parasympathetic nervous system.

5. Which nervous system is responsible for activating the body's reaction to a stressful situation?

a. central

b. parasympathetic

c. somatic

d. sympathetic

6. Dopamine is the neurotransmitter primarily implicated in

a. Huntington's disease.

b. Alzheimer's disease.

c. Parkinson's disease.

d. multiple sclerosis.

7. The brain region most directly related to the processing of fear-relevant information is the

a. amygdala.

b. hind brain.

c. nucleus accumbens.

d. striatum.

8. The _____ is important for basic bodily functions, including respiration and heart rate regulation, as well as for regulating reflexes such as sneezing and coughing.

a. medulla

b. pons

c. cerebellum

d. reticular system

9. Which brain structure degenerates in the disease Multiple Sclerosis?

a. neurons

b. oligodendroglia

c. Schwann cells

d. corpus callosum

10. The evolutionary concept of_____ maintains that those with adaptive genetic traits survive to transmit their genes to their offspring.

a. a matter of brain size

b. modern synthesis

c. parental investment

d. fitness

Fill-in-the-Blank

1. The nervous system is made up of neurons and _____ cells.

2. Neurons receive messages from other neurons via the _____.

3. The type of glial cells that produce and secrete cerebrospinal fluid in the brain are called _____.

4. The _____ principle maintains that action potentials are not graded—that is, they cannot be weak or strong.

5. The _____ subdivision of the peripheral nervous system controls voluntary motor activity.

6. The temporal lobe is important for processing _____ sensory stimuli.

7. Dr. Wilder Penfield developed neurosurgical techniques to treat _____.

8. In nearly all right-handed people, brain areas responsible for language are located in the

_____ hemisphere of the brain.

9. Collections of neurons that communicate with one another in a sequential fashion are referred to as _____.

10. The poison botulin prevents axons from releasing the neurotransmitter _____, resulting in paralysis and death.

CHAPTER 4
Human Development

RyersonClark/E+/Getty Images

CHAPTER OUTLINE

How Is Developmental Psychology Studied?

LEARNING OBJECTIVE 1 Describe and discuss the advantages and disadvantages of cross-sectional and longitudinal designs for researching development.

Understanding How We Develop

LEARNING OBJECTIVE 2 Understand the key debates underlying research and theory in child development.

Heredity and Prenatal Development

LEARNING OBJECTIVE 3 Discuss patterns of genetic inheritance and describe stages and potential problems during prenatal development.

Infancy and Childhood

LEARNING OBJECTIVE 4 Summarize the major physical, cognitive, and emotional developments that take place during infancy and during childhood.

Adolescence

LEARNING OBJECTIVE 5 Summarize the major physical, cognitive, and emotional changes that take place during adolescence.

Adulthood

LEARNING OBJECTIVE 6 Describe the key physical, social, and emotional changes that take place throughout adulthood.

Given that we can remember basically none of our first years, how important can our early experiences actually be for our development as individuals? For example, how important is

it to have at least one responsive parent looking after us, ensuring that our physical, social, and emotional needs are met? Although psychologists are certain that parents *are* important, they have not been able to examine this experimentally. Not ethically.

However, what if there were infants and children who, from weeks to months to years, were living in conditions where there was only one person caring for up to 18 children at a time? Where each child spent 18 to 20 hours a day in a crib without any human contact whatsoever, even being fed by bottles propped on pillows? How do you think children raised in such deprived circumstances would turn out as they grew up (Nelson, 2014)? Elinor Ames, now a Professor Emerita at Simon Fraser University, discovered a natural opportunity to study just such an occurrence. In the early 1990s, as a result of social policies, a great many infants in Romania were surrendered to state-run orphanages. The infants lived in the globally impoverished conditions just described (see photo). Once word of their plight got out to the rest of the world, Canadians (and others) adopted Romanian orphans to help them escape the isolation and deprivation that characterized their lives. A number of Romanian orphans joined families in Canada. In 1991, Ames established the Romanian Adoption Project to follow the progress of adopted Romanian children in British Columbia (for a review, see Tarabulsy & Symons, 2016).

Romano Cagnoni/Getty Images

Romanian orphans In the 1990s, children in state-run Romanian orphanages were often left in cribs by themselves all day, without any human contact. What effects do you think this would have on a child's development?

How did things work out? For about one-third of the children, things turned out well. These children were more likely to have been adopted before 4 months of age, as compared to the two-thirds of children who did not fare as well. All of the children were developmentally delayed (behind other infants their age) when they first arrived, but many (two-thirds) made up their relative developmental delays within the first 6 months. However, some continue to struggle to this day with physical, behavioural, and mental health issues (Mozaffari, 2018).

If you were charting the development of vulnerable infants, what would you focus on?

Unlike other fields in psychology that often focus on what a person is like at a specific moment in life, **developmental psychology** is interested in how behaviour and mental processes change over time. They also study why some characteristics change while others remain relatively stable. In addition to noticing similarities between groups of people, developmental psychologists are also interested in differences between individuals.

> **developmental psychology** the study of changes in behaviour and mental processes over time and the factors that influence the course of those constancies and changes.

So, what happened to make *you* into the person that you have become? Was it genes? Parents? Life circumstances? Do changes occur because of biological factors or because of our experiences? When are we fully developed? Researchers in developmental psychology know that developmental changes do not stop when we leave childhood (see **Table 4.1**). Development is lifelong.

Lifespan developmental psychology involves the study of the entire course of human life, from conception to death. At the Lifespan Development program at the University of Victoria, researchers study how individual, genetic, social, and historical forces influence the entire course of development. As we will see later in this chapter, a trend toward a longer human lifespan and a growing interest in the lifespan developmental perspective has given rise to fields of study such as gerontology and the psychology of aging (Suitor et al., 2019; Jensen, 2011).

TABLE 4.1

Developmental Stages over the Lifespan

Stage	Approximate Age
Prenatal	Conception to birth
Infancy and toddlerhood	Birth to 2 years
Early childhood	2–6 years
Middle childhood	6–12 years
Adolescence	12–20 years
Emerging adulthood	20–25 years
Young adulthood	25–45 years
Middle adulthood	45–60 years
Later adulthood	60 years to death

How Is Developmental Psychology Studied?

LEARNING OBJECTIVE 1

Describe and discuss the advantages and disadvantages of cross-sectional and

longitudinal designs for researching development.

As we've noted, developmental psychologists are interested in learning about changes that happen as we age. But how do they go about measuring those changes?

Working with people who are growing and developing over time requires researchers to devise a research design that will allow them to assess how individuals change (or remain the same) over time, regardless of what they hope to assess. One approach is to use the **cross-sectional design**. In this approach, researchers compare groups of different-aged people to one another at a single point in time (Krettenauer, Murua, & Jia, 2016). For example, they might compare a group of 60-year-olds to a group of 30-year-olds on a memory task to see how memory changes over time. The benefit of the cross-sectional approach is that it's easy and straightforward, as well as convenient, for both researchers and participants.

cross-sectional design a research approach that compares groups of different-aged people to one another.

The big problem with the cross-sectional approach is that it assumes that any changes found in a study are the result of age. Researchers must remember to also consider other factors that might influence their results. Let's say that the task used to measure memory differences between the two age groups mentioned above is computer-based. If the 30-year-olds perform better on the memory task, the researchers might conclude that the results are due to age-related changes in memory. But the findings could be related more to the fact that 30-year-olds are more familiar with and less intimidated by computer technology than some 60-year-olds are.

These sorts of historical differences are called *cohort effects*. A *cohort* is any group of people born at about the same time. As a result of when they were born, the development of people in a particular cohort will be affected by the cultural and historical changes to which they were exposed. Wars, recessions, natural disasters, famines, and anything else that provides particular cohorts with unique experiences or challenges can influence development. If the two groups in your cross-sectional study come from different cohorts, then you cannot be sure whether the differences you see are due to development or cohort differences. For example, to use a historical example, several years ago the provincial government in Alberta cut educational funding by reducing the number of hours of kindergarten education for children. If we were comparing the development of Alberta children in Grades 1 and 3, we might miss the fact that the better school performance of the Grade 3 children is at least partially a cohort effect of their longer kindergarten experience, and not entirely due to developmental differences (Hughes, Lowe, & McKinnon, 1996).

Another drawback of cross-sectional research is that it does not provide much explanation of how or when age-related changes may have occurred. For example, if in the memory study researchers find that older participants demonstrate memory declines, the researchers wouldn't know whether the declines occurred suddenly or accumulated gradually over the past 30 years.

Because of the many drawbacks associated with cross-sectional research, many

developmental researchers prefer to use a **longitudinal design** (see **Figure 4.1**). This design allows researchers to follow the same group of people over a period of time, administering the same tasks or questionnaires to them at different points in their lives to see how their responses change. Sometimes getting a good start means getting a head start. For an overview of a longitudinal design that is designed to follow children from early childhood into their school years see Positive Psychology 4.1.

longitudinal design a research approach that follows the same people over a period of time by administering the same tasks or questionnaires and seeing how their responses change.

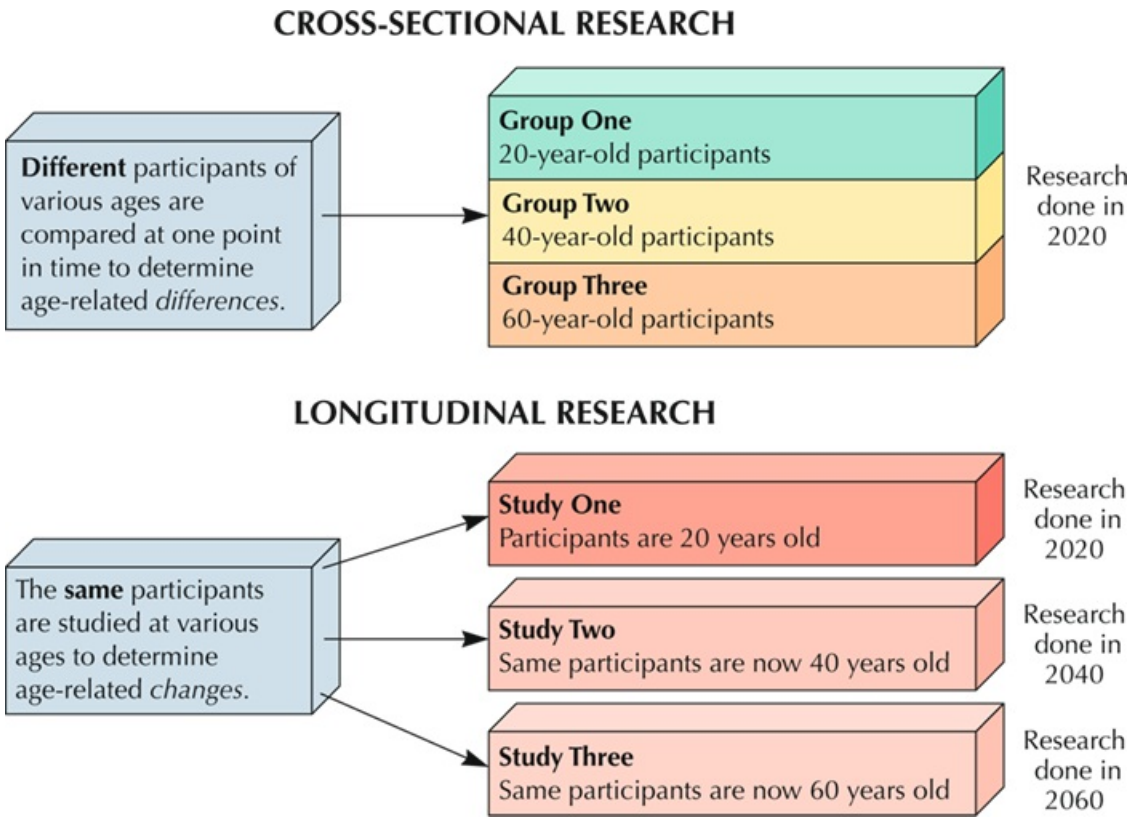


FIGURE 4.1 Cross-sectional versus longitudinal research design Cross-sectional research studies different participants of various ages at one point in time to examine age-related differences. Longitudinal research studies the same participants over a longer period of time to determine age-related changes. Adapted with permission of John Wiley & Sons, Inc., from Carpenter, S., & Huffman, K. (2013). *Visualizing psychology*, 3rd edition. Hoboken, NJ: Wiley, p. 232.

The main benefit of longitudinal research is that researchers can be reasonably confident that the observed changes are a function of time and developmental experiences. Unfortunately, longitudinal studies require considerable time and money. Moreover, many participants in longitudinal studies drop out of the studies over the course of their lives because they move away, lose interest, become ill, or even die (see **Table 4.2**). And, finally, the cohort effect poses a problem for the longitudinal design as well. Individuals being

followed belong to a single cohort; so, although age effects can be observed in the cohort group under study, there is no way to know whether the observations can be generalized to other cohort groups.

4.1 Psychology Around Us | Positive Psychology

Aboriginal Head Start on Reserve and Aboriginal Head Start in Urban and Northern Communities in Canada

The school dropout rate for Canadian Indigenous and Métis youth is three times that of the general population (25 percent versus 8 percent) (Wilson, Rosenberg, & Ning, 2016; Richards, 2014). In an effort to address this issue by offsetting the effects of early adversity, the Government of Canada has provided funds for two preschool programs, offered in all provinces and territories: the Aboriginal Head Start on Reserve (AHSOR) program for Indigenous families living on reserve, and the Aboriginal Head Start in Urban and Northern Communities (AHSUNC) for Indigenous families living off-reserve in urban and northern communities.

AHSOR programs provide a half-day preschool experience for 3- to 5-year-old Indigenous and Métis children. Since research shows that children and families benefit maximally from active family engagement, parents are encouraged to participate, to become supporters of and advocates for their children's academic and social development. In addition, these programs provide support for development of Indigenous culture and language, education, and school readiness programming, along with health promotion, nutrition, and social support (Mashford-Pringle, 2012; Public Health Agency of Canada, 2011). Evaluation data gathered at Alberta AHSOR sites (Robertson, 2015; dela Cruz, 2010) showed that when participants entered the school system, they performed at or above levels of children their age in the general Canadian population. This finding suggests that the AHSOR program is meeting its immediate goals. Next, researchers need to longitudinally follow the children through school to see if early childhood involvement in AHSOR programs reduces Indigenous and Métis youth school dropout rates.

In an effort to better understand the parental involvement feature of AHSUNC, Alison Gerlach, at the University of Northern British Columbia, and her colleague, Joan Gignac, from the Aboriginal Head Start Association of British Columbia, explored how educators at AHSUNC sites engaged with parents and families (2019). Gerlach and Gignac interviewed parents, Elders, and AHSUNC program coordinators and family workers. Results indicated that coordinators and workers took their relationships with the families of the children in their care very seriously and defined their role as one of supporting the entire family, not just the child in the program. Educators had a deep understanding of the daily struggles facing many of the families in terms of mental health issues, housing and food insecurity, multi-layered ongoing demands, high levels of stress, and social and relational issues, and were therefore able to establish lasting, non-judgemental, and trusting relationships with the caregivers. As well, program staff and Elders identified how important the program was for supporting parents in their parenting role; this external support led to increased self-esteem, self-efficacy, self-belief, and confidence in themselves as parents, which in turn led to greater

involvement. The authors also noted that another positive feature of the program was that it connected parents to other parents both virtually and physically and therefore played a vital function in reducing the effects of social isolation for parents. Connecting to Elders and connecting families to their Indigenous identities and heritages was also an important feature of the program for parents and children alike. The authors conclude that these approaches for engaging families are important not only in Indigenous contexts but also in any context where families are coping with disadvantage, alienation, and marginalization.

THE CANADIAN PRESS/Sean Kilpatrick

Culturally appropriate childcare Prime Minster Justin Trudeau reads to children at a culturally inclusive and hands-on parenting program for young children and their families in Yellowknife, Northwest Territories.

Seeking to address the cohort effect, some developmental researchers use a design that combines both the cross-sectional and the longitudinal methods. A **cohort-sequential design** comprises two or more longitudinal studies, each covering the same spans of time but conducted with different age groups (Prinzie & Onghena, 2014). For example, to compare prevalence rates for substance abuse in Indigenous adolescents in both the United States and Canada, one study followed groups of adolescents from various locations over eight years (Whitbeck et al., 2014). The first group was 11.3 years old at year 1. The second year another group was added and both groups were interviewed. In the third year another group of adolescents (11.3 years) was added once again (while the original two groups were interviewed, now at ages 13.3 [year 1] and 12.3 years [year 2]). This same procedure was followed for 8 years. By using this design, the researchers could measure any differences between the groups that persisted over time, but in different cohort groups. However, because of the age overlap among groups over time, they could also look at differences that might result from age. In this particular study, Whitbeck et al. (2014) concluded that First Nations youth were at greater risk for substance abuse disorders than Caucasian youth. However, both groups of youth demonstrated a pattern where behavioural disorders, when evident, peaked in mid-adolescence but expanded into substance abuse disorders by young adulthood.

cohort-sequential design blended cross-sectional and longitudinal research, designed to look at how individuals from different age groups compare to one another and to follow them over time.

TABLE 4.2

Comparison of Cross-Sectional and Longitudinal Research Designs

	Cross-Sectional Design	Longitudinal Design	Cohort-Sequential
Advantages	Quick, easy, and straightforward Convenient for both researchers and participants Yields information about age differences	Gives reasonably reliable information about age changes Gives information about the stability or instability of traits Gives information about the effects of early experiences	Cohort effects can be separated from age effects Gives reliable information about age changes Gives information about the stability or instability of traits Gives information about the effects of early experiences
Disadvantages	Cohort effects are difficult to separate from age effects Does not explain how or when changes may have occurred—measures behaviours at only a single point in time	Requires considerable time and money Many participants drop out over the course of study Cohort effects are not controlled as all participants	Requires considerable time and money Many participants drop out over the course of the study

		come from the same cohort	

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

1. What is the main advantage of using a longitudinal design instead of a cross-sectional design?

What Do You Think? • If a researcher today finds differences between a group of 20-year-olds and a group of 70-year-olds, what historical, social, and cultural factors might have contributed to those differences?

Understanding How We Develop

LEARNING OBJECTIVE 2

Understand the key debates underlying research and theory in child development.

Before we discuss what happens in development, it's useful to consider some of the key issues that concern developmental psychologists. These issues are often foundations for theory, research, and clinical work, but they are not always directly tested. As you read through the rest of the chapter, you may want to think about how the theories we discuss fit with these big ideas about human development.

What Drives Change? Nature and Nurture

A key historic debate in human development is how much of our growth, personality, and behaviour is influenced by *nature*, our genetic inheritance, and how much is influenced by *nurture*, a term that encompasses the environment around us as well as our experiences as we grow.

Scientists who take a strong view of the influence of genetics or biology on development look at development as biologically programmed to happen sequentially, a process known as **maturation**. Other scientists believe that our experiences have a greater influence on how we develop (see photo).

maturation the unfolding of development in a particular sequence and time frame.

What do you see as the main influence accounting for the difficulties experienced by some of the Romanian orphans, which were discussed earlier? Clearly, while nature may play a role, there is a lot of nurture involved in the difficulties the orphans experienced as well, both in Romania and in Canada.

Amble Design/Shutterstock.com

Nature versus nurture **How much of our growth, personality, and development is attributed to our genetic inheritance or the environment we grow up in is still a key debate in human development.**

It is not as easy, however, to attribute the characteristics of people in general to either nature or nurture exclusively. Our traits and behaviours are almost always influenced by an interaction between genes and environment. It is better to think of development as an inevitable and ongoing interaction between nature *and* nurture. In fact, we know that experiences cause **epigenetic** changes to genes that can be passed down from parent to child (Roth, 2014). Nevertheless, in spite of the clear evidence that nature and nurture work together, some researchers continue to debate whether nature or nurture is more important. You will see that the so-called nature–nurture issue applies not only to specific questions about development, but also to ideas about intelligence (Chapter 10), social behaviour (Chapter 13), and psychological disorders (Chapter 15).

epigenetic changes in gene expression that are independent of the DNA sequence of the gene.

Qualitative versus Quantitative Shifts in Development

Throughout this chapter, whether we are referring to physical development, social development, or cognitive development, you will notice that we often talk about **stages**. A stage is a developmental point or phase within which children, adolescents, or adults think, experience emotions, or behave in particular ways. Stages usually involve *discontinuous* development with clear qualitative differences in thinking or behaviour between one stage and another.

stage a distinct developmental phase in which organisms behave, think, or respond in a particular way that is qualitatively different from the way they responded before.

It is important to understand what is meant by quantitative and qualitative change. *Quantitative change* involves gradual increases in some element, such as height or weight. In contrast, when we talk of *qualitative change*, it is not just that we are bigger, faster, or more coordinated, but that we are *different* in some way. For example, a caterpillar can grow little by little into a bigger caterpillar—a quantitative change—but when the caterpillar becomes a butterfly, there has been a qualitative change. We will talk about Piaget's theory of cognitive development shortly; as you will see, Piaget argued that children think differently at different stages of development. He therefore viewed this type of thinking behaviour, called cognition, as a qualitative change that occurs over the lifespan (Piaget, 1952).

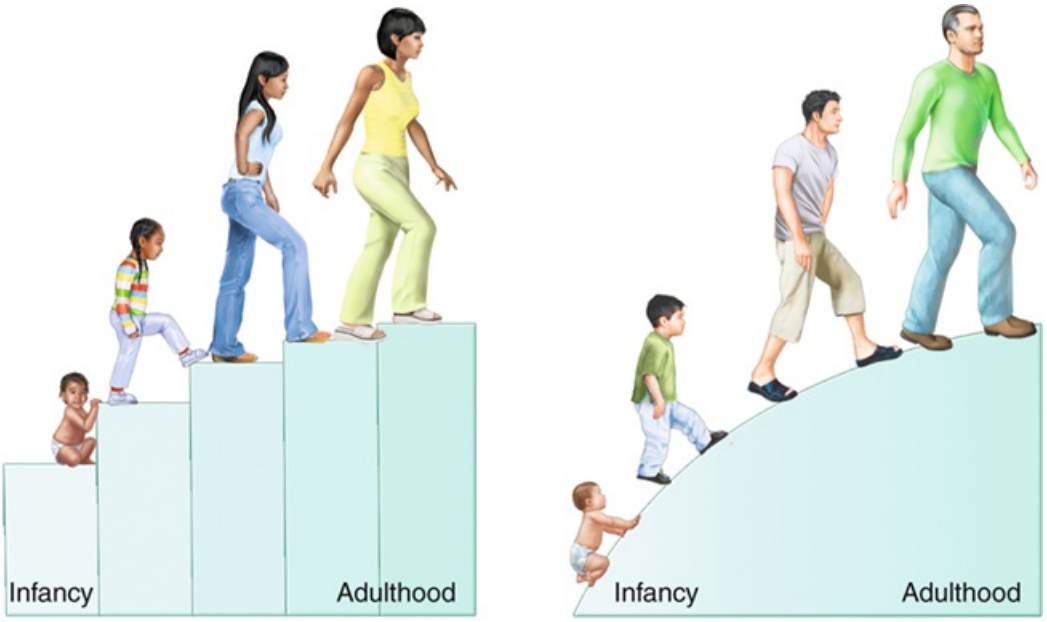
Although stages are typically associated with *qualitative* change, some developmental researchers argue that stages represent instead *quantitative* shifts in the growth of individuals (see **Figure 4.2**). According to these theorists, development is the result of an ongoing acquisition of new information and new experiences. What may seem like a sudden developmental change may instead actually represent the result of a gradual accumulation of many small changes, often so small that they are hard to notice, reaching a detectable threshold after the accumulation of many quantitative changes. For example, some theorists and researchers believe that walking comes as a result of a series of small developmental changes, including the steady growth of our muscles until they can hold our body weight and the development of our brains until they can control physical coordination (Walle, 2016; Adolph & Tamis-LeMonda, 2014).

Quantitative theorists have an easier time than qualitative theorists accounting for individual differences in the timing of milestones, but a harder time explaining why most people go through similar sequences of development during similar times of life, despite considerable variations in their experiences. As we will see, human development involves both qualitative and quantitative processes.

Do Early Experiences Matter? Critical Periods and Sensitive Periods

Related to the question of stage theories versus continuous theories of development is the question of whether there are **critical periods** in human development. A *critical period* is a point in development when the organism is extremely sensitive to a particular environmental input that can either encourage or discourage the development of certain brain functions (Werker & Hensch, 2015; Toyoizumi et al., 2013). So, if environmental input does not occur at a specific point in time, or if a noxious substance or experience is encountered, development will be thrown off track (hence, the term *critical*). For example, ethologist Konrad Lorenz (1970, 1971, 2002) found that goslings will forever connect with whatever goose-sized moving stimuli they see most often during the first 36 hours of their lives. In Lorenz's work, he was able to get certain goslings to think of him (or more specifically, his boots) as their mother. He used the term *imprinting* to describe the development of this attachment—the goslings imprinted upon Lorenz (Vicedo, 2020). The results are clear in the photo.

> **critical periods** points in development when an organism is extremely sensitive to environmental input, making it easier for the organism to acquire certain brain functions and behaviours.



(a) Qualitative development (b) Quantitative development

FIGURE 4.2 Do stages represent qualitative or quantitative shifts in development? (a) Some theorists believe that individuals make qualitative, discontinuous jumps in development as they move from stage to stage. (b) Others think that development is a steady continuous process.

Nina Leen/The LIFE Picture Collection/Getty Images

The followers Ethology pioneer Konrad Lorenz led these baby geese into viewing

him as their mother by being sure he (or more specifically, his boots) was the first approximately goose-size being they saw when they hatched. For geese, the first 36 hours after birth is a critical learning period during which they become imprinted to their mother—or in this case, a mother substitute.

Psychologists have long been curious about whether critical periods operate in the lives of human beings. Of course, it would be unethical for researchers to deprive human beings of their usual early experiences to see what would happen. However, cases of human deprivation—extreme poverty or chronic abuse at the hands of parents, for example—do sometimes tragically occur without artificial intervention. By studying the histories of children in these adverse situations, researchers have learned that serious psychological disabilities may result from early deprivation (Cecil et al., 2017; Kennedy et al., 2016; Oliveira et al., 2015; Kumsta et al., 2015). At the same time, however, other studies have found that subsequent changes in environmental input (for example, removing deprived children from their early negative environments and placing them in more positive ones) can help the children recover partially or, in some cases, completely (Humphreys et al., 2015; Fisher, 2014; Sheridan et al., 2012). (See photo.)

Robert van der Hilst/Getty Images

All is not lost Early deprivation, such as that experienced by these young children at a Vietnamese orphanage, can result in severe psychological disabilities. Moving the children to more positive and stimulating settings, however, can help many of them to recover at least partially.

Because individuals can recover at least partially even after deprivation during key time periods in their lives, most of today's psychologists and biologists believe that critical periods are better defined as *sensitive periods*, times when individuals are especially receptive to environmental input, but not rigidly so (Frankenhuis & Fraley, 2017; Baird, 2010). Adélaïde de Heering and Daphne Maurer at McMaster University (2014) have studied adult patients with bilateral congenital cataracts and have shown that critical and sensitive periods in early life are particularly influential in the development of the visual system. They found that patients experienced much greater difficulty than control

participants in recognizing both famous faces and recently learned faces. This finding suggests that early visual input is necessary for face identification. For more complex cognitive and social development, however, theorists today view sensitive periods as largely *experience-driven*, flexible, and with less well-defined boundaries than critical periods (Bornstein, 2014).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

2. How do quantitative theories of development differ from qualitative theories of development?

3. What is the difference between a critical period and a sensitive period?

What Do You Think? • Do you see biological or environmental factors as playing more of a major role in your own development?

Heredity and Prenatal Development

LEARNING OBJECTIVE 3

Discuss patterns of genetic inheritance and describe stages and potential problemsduring prenatal development.

The **prenatal period** encompasses the nine months or so from conception to birth. At conception, each biological parent contributes half of the genetic material required to create a new person. Thus, at the moment of conception the baby's genes and sex are set. Growth following conception occurs at an exponential (rapid) rate.

prenatal period the period of development from conception to birth.

Courtesy of Matt and Ginny Mooney

Genetic defects **Eliot Mooney was born with Trisomy 18, a chromosomal abnormality due to an error in cell division resulting in three #18 chromosomes instead of two. Most children born with this condition do not live to their first birthdays. Eliot lived 99 days, each day celebrated and recorded by his parents, Matt and Ginny Mooney. In 2007 they established www.99balloons.org to help disabled children and their families. A video of Eliot's life can be found on this website http://mattandginny.blogspot.ca/.**

CNRI/Science Source

Magical pairs **A person's entire genetic inheritance is contained in 23 pairs of chromosomes, with each parent contributing one chromosome to each pair. Here we see an individual's chromosomes stained with dyes and photographed under a microscope.**

In the Beginning: Genetics

Genes are the most basic building blocks of our biological inheritance (Kimura, 2020). Each gene is composed of a specific sequence of **deoxyribonucleic acid**, or **DNA**, molecules. DNA and genes are arranged in strands called **chromosomes**, found in each cell of our bodies (see photo). In most cases each sperm and each egg (ovum) have 23 chromosomes. When the sperm fertilizes the ovum, a single-celled organism, usually with 46 chromosomes, is created. The majority of conceptions containing errors in the number of chromosomes end in miscarriage, with approximately 15 to 20 percent of pregnancies resulting in a miscarriage in the first 8 weeks (Society of Obstetricians and Gynaecologists of Canda (SOGC), 2020). However, about 1/150 children are born with a chromosomal abnormality, where they have too few or too many chromososmes (Feldkamp et al., 2017). (See photo.)

genes basic building blocks of our biological inheritance.

deoxyribonucleic acid (DNA) molecules in which genetic information is enclosed.

chromosomes strands of DNA; each human being has 46 chromosomes, distributed in pairs.

Twenty-three chromosomes are contributed by each of our biological parents, and the resulting combination is called our **genotype**, which broadly refers to a person's genetic inheritance. A person's **phenotype** is the observable manifestation of that genotype, the physical and psychological characteristics that are on display in each individual (Waddington, 2016).

genotype a person's genetic inheritance.

phenotype the observable manifestation of a person's genetic inheritance.

It is difficult to determine a person's genotype solely on the basis of his phenotype—appearance or behaviour. Consider the appearance of freckles. Freckles are genetically determined; either you are born with them or not (Araki et al., 2016). If you have freckles, you display a freckles phenotype. Without further information, however, we cannot say exactly what your genotype is. Variations of the same gene, such as the gene for freckles, are called **alleles**. If both parents contribute the same allele, then the person is **homozygous** for the trait—that is, she has two matching alleles of the same gene. If you have freckles, you *may* be homozygous for the freckles gene (Kumar, 2019).

allele variation of a gene.

homozygous having both parents contribute the same genetic material for a particular trait.

It turns out, however, that people have freckles if they inherit a freckles allele from one of their parents and a non-freckles allele from the other. In such instances, individuals have the observable phenotype of freckles, but their genotype is **heterozygous**, a combination of two different alleles (Kumar, 2019). Thus, if you have freckles, you are displaying a freckles phenotype, and this phenotype may reflect either a homozygous or a heterozygous genotype (see **Figure 4.3**).

heterozygous having parents contribute two different alleles to offspring.

David Roth/Getty Images

Freckles and genes **Freckles are small, concentrated spots of a skin pigment called melanin, controlled primarily by the MC1R gene. Freckles show a dominant inheritance pattern: parents who have freckles tend to have children with freckles. Variations, also called alleles, of MC1R control freckle number. Other genes and the environment influence freckle size, colour, and pattern. For example, sun exposure can temporarily cause more freckles to appear.**

Depending on the trait in question, any of three different phenotypes can result when a person has a heterozygous combination of different alleles (adapted from Truett et al., 1994):

One possibility is that the trait either will be expressed in its entirety or will not be expressed at all. This is the case with freckles. If you have one "freckles" allele and one "non-freckles" allele, you will have freckles. Having freckles is a **dominant trait**, a trait that is expressed in your phenotype regardless of whether your genotype is homozygous or heterozygous for the trait (see photo). A **recessive trait**, on the other hand, is one that is expressed in your phenotype only when you are homozygous for that trait. Not having freckles is recessive. You must have two matching "non-freckles" alleles to be prevented from having freckles.

dominant trait a trait that is expressed in a phenotype, no matter whether the genotype is homozygous or heterozygous for the trait.

recessive trait a trait that is only expressed if a person carries the same two genetic alleles (e.g., is homozygous for the trait).

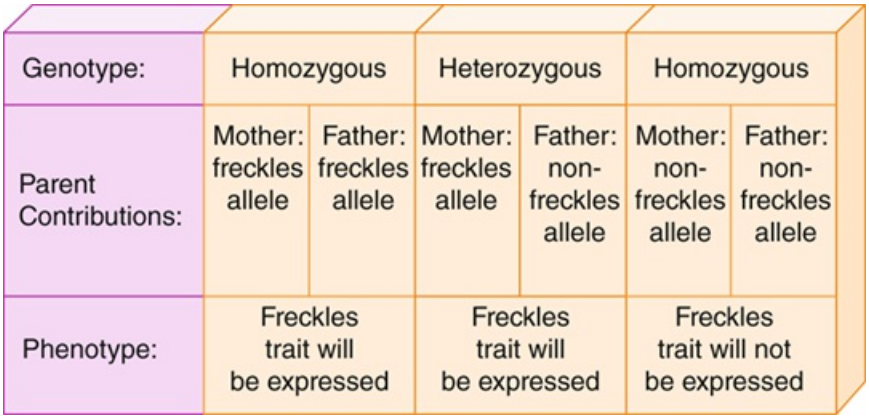


FIGURE 4.3 Genotype versus phenotype **Individuals with freckles may have either a homozygous or a heterozygous genotype for freckles. In contrast, people who do not have freckles must have a homozygous genotype for freckles.**

For some traits, a person with a heterozygous pair of alleles may show a *mixture* of genetic coding. For example, children of couples who have different racial backgrounds can have features associated with the backgrounds of both parents, such as blended skin colour or eye shape.

For yet other traits, persons with a heterozygous pair of alleles may express *both* of the parents' genes in their phenotype. This outcome is called **codominance**. An example of codominance is found in blood type. If one parent has blood Type A and the other parent has Type B, the child can express both in the form blood Type AB.

codominance what occurs when in a heterozygous combination of alleles, both traits are expressed in the offspring.

The thing that makes the study of genetics particularly challenging is that only a few of our traits are **discrete traits**, the product of a single gene pair. Instead, most human traits are **polygenic traits**, traits like height, weight, intelligence, or skin colour, which involve the combined impact of multiple genes. It is especially likely that traits affecting our behaviour are polygenic. There is evidence, for example, to suggest that schizophrenia (Purcell et al., 2014) and depression (Holmes et al., 2012) may be polygenic.

discrete trait a trait that results as the product of a single gene pairing.

polygenic trait a trait that manifests as the result of the contributions of multiple genes.

However, it is important to remember that very few genetic influences occur without environmental modification. Our environment plays a very strong role in determining our developmental outcome. DNA provides a blueprint, but at critical points in development experience creates a genetic memory—via trace chemicals—that change how the instructions on the DNA are carried out. These epigenetic changes to the DNA can be temporary or reversible, but many times these changes are permanent and possibly

heritable (Alberta Family Wellness Initiative [AFWI], 2017).

Prenatal Development

Prenatal development begins with *conception* when a sperm fertilizes an egg, resulting in the creation of a single cell, called a **zygote**. The first two weeks after conception is known as the *germinal stage*. During the first 36 hours of this stage, the single cell zygote divides and becomes two cells. These two cells then divide to become four, those four divide and become eight, and so on. As its cells keep multiplying, the zygote moves through the mother's Fallopian tube (where it was first fertilized) to her uterus. After the fourth day following conception, the zygote is now referred to as the *blastocyst*. About a week after fertilization, the blastocyst implants itself to the side of the uterus. The other major transition that occurs during the germinal stage is the formation of a nutrient-rich structure called the **placenta**, which attaches to the wall of the uterus. The placenta allows the circulatory system of the mother to interact with the circulatory system of the embryo to exchange oxygen and nutrients through the umbilical cord.

zygote a single cell resulting from successful fertilization of the egg by sperm.

placenta a nutrient-rich structure that serves to feed the developing fetus.

Implantation signals the second stage of the prenatal period, called the *embryonic stage* (2 to 8 weeks). Most of the major systems of the body, such as the nervous and circulatory systems, as well as the basic structure of the body, begin to take shape during this stage. It is during this stage that the new organism is most vulnerable to environmental influence. By the eighth week, most of the basic organ systems are complete and the third stage of development, or *fetal stage*, begins (see **Figure 4.4**). The fetal stage lasts from the end of the embryonic stage until the birth of the baby (9 to 40 weeks). Although most of the basic organ systems are already formed by the end of the embryonic stage, these early body systems are neither fully developed nor functional and therefore cannot sustain life on their own. During the fetal stage, these immature organ systems and structures continue to grow and develop. Especially during the last three months, the fetus's brain begins to grow at a remarkable pace (Bouyssi-Kobar et al., 2016).

Abnormalities may arise during prenatal development and may lead to a **miscarriage** (or spontaneous abortion). A miscarriage occurs when the pregnancy is naturally and spontaneously expelled from the uterus before the embryo or fetus is able to function on its own (prior to about the 20th week of pregnancy) (Robinson, 2014). Miscarriages are fairly common; in fact, the Canadian Federation for Sexual Health estimates that one in every four conceptions ends in a miscarriage. In addition, the Society of Obstetricians and Gynaecologists of Canada states that one in six women who know they are pregnant will experience a miscarriage (SOCG, 2020). The *age of viability* refers to the point at which the baby can survive on its own (Kelly & Welch, 2016). Preterm infants are infants delivered before the 37th week gestational age. Small-for-date infants are 10 percent or more below the weight for babies of the same gestational age. Either condition can occur alone or they can occur in combination. Canadian mothers who are very short, or who are under stress and/or who gain too little weight during pregnancy are at higher risk for having a small-for-date or preterm infant (Heaman et al., 2013).

miscarriage discharge of the fetus from the uterus before it is able to function on its own.

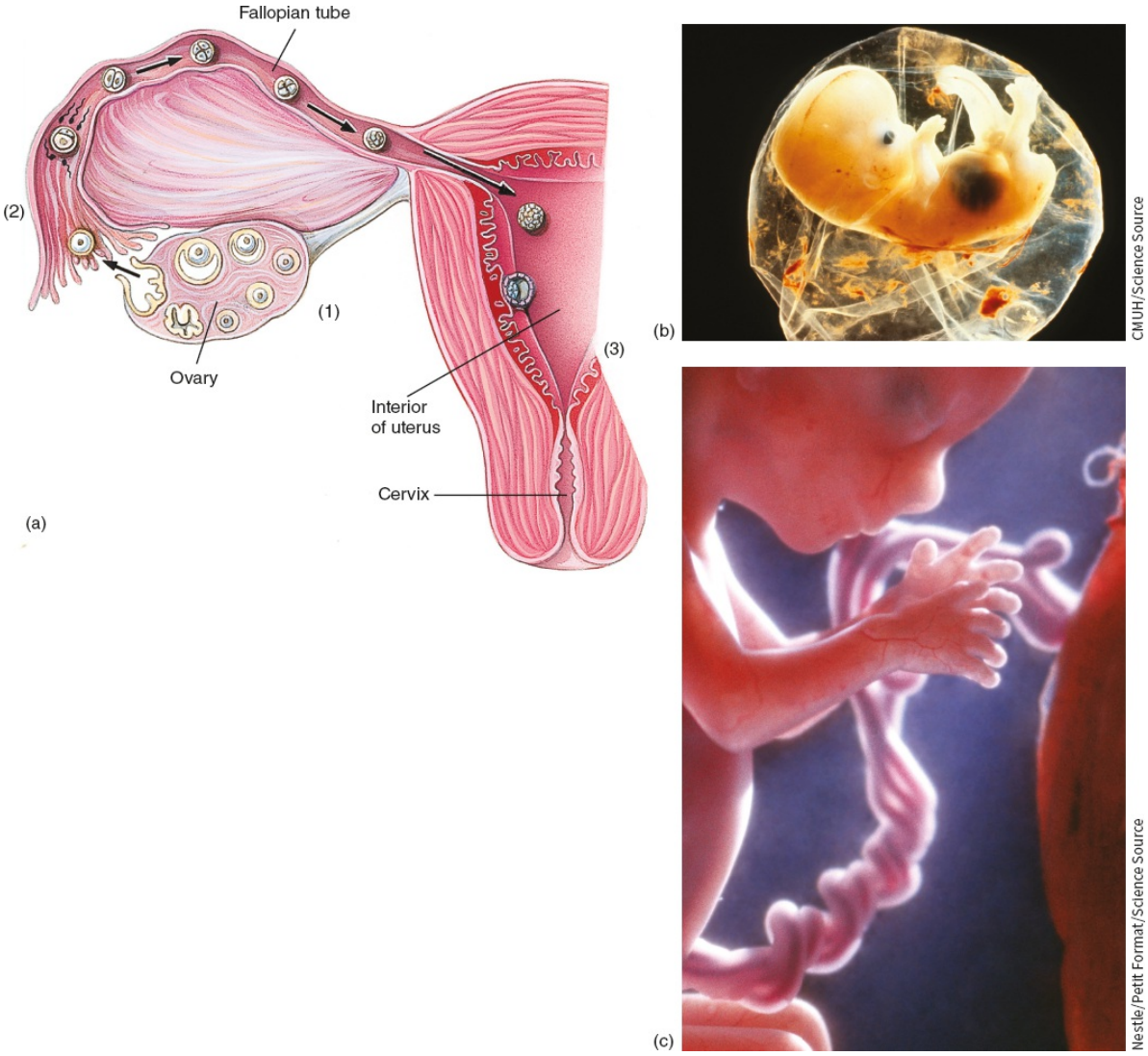


FIGURE 4.4 Prenatal development **(a)** ***Germinal period: From ovulation to implantation:*** **After the egg leaves the ovary (1), it travels to the opening of the Fallopian tube (2) where it is fertilized and becomes a zygote. About a week later, the zygote reaches the uterus, implants itself in the wall of the uterus (3), and triggers the formation of the nutrient-rich placenta. (b)** ***Embryonic stage:*** **The zygote grows rapidly once it is implanted. By 8 weeks, many external body structures and internal organs have been formed. Notice that the head grows faster than the rest of the body. At this stage, the embryo is vulnerable to miscarriage. (c)** ***Fetal stage:*** **From 8 weeks to birth, the fetus continues to enlarge rapidly and the basic structures undergo substantial change.**

Prior to Birth

The fetus is vulnerable to any number of influences immediately following conception. As you will see throughout the book, many disorders expressed in children are inherited from the parents. Some of these disorders, such as sickle-cell anemia, cystic fibrosis, or phenylketonuria (PKU), are linked to recessive genes, whereas others, such as Marfan syndrome or Huntington disease, are caused by dominant genes. Still other disorders are linked to chromosomal problems that are not inherited. In Chapter 10, for example, when we talk about intelligence, we will also talk about *Down syndrome*, a pattern caused by all or part of a third chromosome in the twenty-first chromosome pair.

In addition to genetic and chromosomal problems, a number of environmental agents, called **teratogens**, can cause damage during the prenatal period. The word "teratogen" stems from the Greek word terato-, meaning "marvel" or "monster" (Harper, 2014). Teratogens can negatively disrupt development during the prenatal period. A great number of agents (diseases, toxins, drugs, hormones, etc.) can interfere with typical prenatal development. The nature and extent of their impact upon the developing fetus vary depending on a number of factors, including the dose of the teratogen, the timing and extent of exposure, and the age of the organism (zygote, embryo, or fetus). It is important to note that not all teratogenic effects result in immediate physical impairment; instead, some health effects are delayed and may not appear until later in childhood or even until adulthood. Below we list a few teratogens, along with their potential effects:

> Over half of the infants exposed to rubella (also known as three-day measles) during the embryonic period suffer from serious defects, such as deafness, intellectual disability, and a number of internal system defects (Thompson et al., 2014). Infants exposed in the fetal period show fewer physical defects, but are at increased risk of mental illness in adulthood, particularly schizophrenia (Torrey & Yolken, 2017), as well as diabetes, cardiovascular disease, anxiety, and thyroid and immune function problems (Cunningham et al., 2010).
>
> Some other diseases that exert a teratogenic effect are syphilis, genital herpes, and AIDS (Wigmore & Salgueiro, 2017; Dutta, 2015). The Zika virus, which the World Health Organization labelled a public health emergency, was added to this list (Gérardin et al., 2017; Panchaud et al., 2016)
>
> Research carried out by Peter Fried at Carleton University suggests that prenatal exposure to marijuana may be linked to disturbances in executive functioning (Smith et al., 2016). Such a cognitive disturbance would cause difficulties with impulsiveness, overactivity, inattention, and problem-solving. Prenatal marijuana exposure is also linked to increased risk for depression in mothers following delivery (Ko et al., 2018).
>
> Smoking tobacco at any point in the pregnancy increases the likelihood of a miscarriage, the baby being born with low birth weight, increased risk for cleft lip and palate, or premature birth (see photo). Smoking tobacco in pregnancy is also related to other postnatal risks, such as sudden infant death syndrome, asthma, and the development of cancer in later childhood (Bajanowski & Vennemann, 2017; Joshua, 2017; Schechter & Kollins, 2017).
>
> Exposure to alcohol affects prenatal development at any point in pregnancy, but especially when brain growth is most rapid early in gestation. Prenatal exposure to alcohol interferes with the production of neurons and prevents neurons from

migrating to where they are needed to form neural networks in the brain. As well, the oxygen required to metabolize alcohol uses oxygen required for cell growth. Therefore, drinking alcohol during pregnancy is inadvisable; it can result in fetal alcohol spectrum disorder (FASD), a preventable lifelong disability involving a range of physical, mental, and behavioural outcomes (Landgren, 2017). (See photo.) Although there are currently no accurate statistics on FASD rates in Canada, it has been estimated that 3,000–4,000 FASD-affected infants are born each year in Canada (Fuchs, Burnside, & Marchenski, 2010). Recent results published by a group of researchers from the University of Toronto suggest that prevalence rates among elementary school children in Ontario ranges from 2 to 3 percent (Popova et al., 2019).

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Smoking and prenatal development **Some effects of smoking during prenatal development include premature birth, low birth weight, and sudden infant death syndrome.**

There are three primary diagnoses associated with FASD: fetal alcohol syndrome (FAS); partial fetal alcohol syndrome (p-FAS), and alcohol related neurodevelopmental disorder (ARND). FAS is generally associated with heavy maternal drinking throughout the pregnancy, and includes slow physical growth, facial abnormalities, and brain injury (Hoyme & Coles, 2016). Children diagnosed with p-FAS have the characteristics associated with FAS, but fewer of them. This diagnosis is associated with mothers who drank less during the pregnancy and/or may be associated with paternal alcohol use at the time of conception (Nash et al., 2013). ARND is associated with maternal alcohol use in pregnancy. It is not associated with facial or physical abnormalities of any type; however, it impacts three areas of mental functioning (see Cook et al., 2016 for Canadian guidelines for diagnoses).

Lyn Alweis/Denver Post/Getty Images

Fetal alcohol syndrome **Caused by early prenatal exposure to alcohol, FAS presents several characteristic facial features (some shown by these children), including short eyelid opening, a thin upper lip, and a smooth philtrum, the groove between the bottom of the nose and the crease of the upper lip.**

The latest edition of The Diagnostic and Statistical Manual of Mental Disorders (DSM-5, 2013) classifies all forms of FASD as "Neurodevelopmental Disorder associated with Prenatal Alcohol Exposure (ND-PAE)."

Heroin use in pregnancy causes babies to be born with low birth weight and addicted to heroin; they must go through withdrawal after birth (Volkow, 2016).

teratogens any environmental agent that causes damage during gestation.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

4. What are the possible phenotypic outcomes from a heterozygous genotype?

5. What are teratogens and what do their effects depend upon?

6. What are the three stages of prenatal development, and what happens at each stage?

What Do You Think? • Given that teratogens are considered to be any environmental agent that can cause damage to the developing organism, what other factors, other than those identified above, could be considered teratogenic? (Hint: physical injury to the mother that affects the developing zygote, embryo, or fetus.)

Infancy and Childhood

LEARNING OBJECTIVE 4

Summarize the major physical, cognitive, and emotional developments that take place during infancy and during childhood.

One of the most extraordinary things about development is how rapidly humans change and grow over the life span. Neonates become infants, infants become children, children become adolescents, and adolescents become adults. As outlined in Table 4.1 earlier in this chapter, all stages of development are important, but the foundation of brain architecture is established early in life, and therefore the early years are of paramount importance. In 2011, Canadians Hon. Margaret McCain (former lieutenant governor of New Brunswick), the late Fraser Mustard (a founding member of McMaster University's medical school), and Kerry McCuaig (Fellow in Early Childhood Policy at the Atkinson Centre at OISE) published a report called *Early Years Study 3: Making Decisions and Taking Action* (McCain, Mustard, & McCuaig, 2011), documenting the vital importance of investing in early learning opportunities for Canadian children. They presented impressive evidence to support their argument that experiences from conception onward shape the architecture and function of the brain. Further, they argued that what happens in the early years has lifelong consequences for both the individual and the society in which the individual lives. Let's examine some of the evidence for why the early years are so crucial to long-term outcomes. See Positive Psychology 4.2 for more on this.

JBryson/Getty Images

Proportions The heads of infants are much larger in proportion to their bodies than the heads of toddlers or adolescents.

Physical Development

Two patterns are apparent in babies' growth and development, both pre- and postnatal. First, growth follows a **proximodistal pattern**. That is, parts closer to the centre of the body grow and develop sooner than parts at the outer edges (the extremities) (Logsdon, 2011). In this way, our most vital organs and body parts form first. For example, brain and

body developments such as myelinization primarily follow a proximodistal pattern, in which parts closer to the centre (that is, the spine) develop sooner than parts at the outer edges (the extremities). As an example of this type of physical development, infants are able to roll over before they can use their fingers. Second, growth follows a **cephalocaudal pattern**, from head to foot. You have probably noticed, for example, that the heads of infants are much larger in proportion to their bodies than the heads of toddlers, older children, or adults (see **Figure 4.5** and photo).

proximodistal pattern a pattern in which growth and development proceed from the centre to the extremities.

cephalocaudal pattern a pattern in which growth and development proceed from top to bottom.

Compared to some other species, human infants are still relatively "unfinished" at birth and remain dependent on their caregivers for many years. Evolutionary data suggest that physical dependency plays a role in the development of handedness, language acquisition, dexterity, and interpersonal skills (Berecz et al., 2020). The infant's sensory systems develop fully during the first year of life and infants learn to walk after about a year or so, but the human brain (see **Figure 4.6**) is not fully mature until about 25 years of age (Cohen et al., 2016; Somerville, 2016).

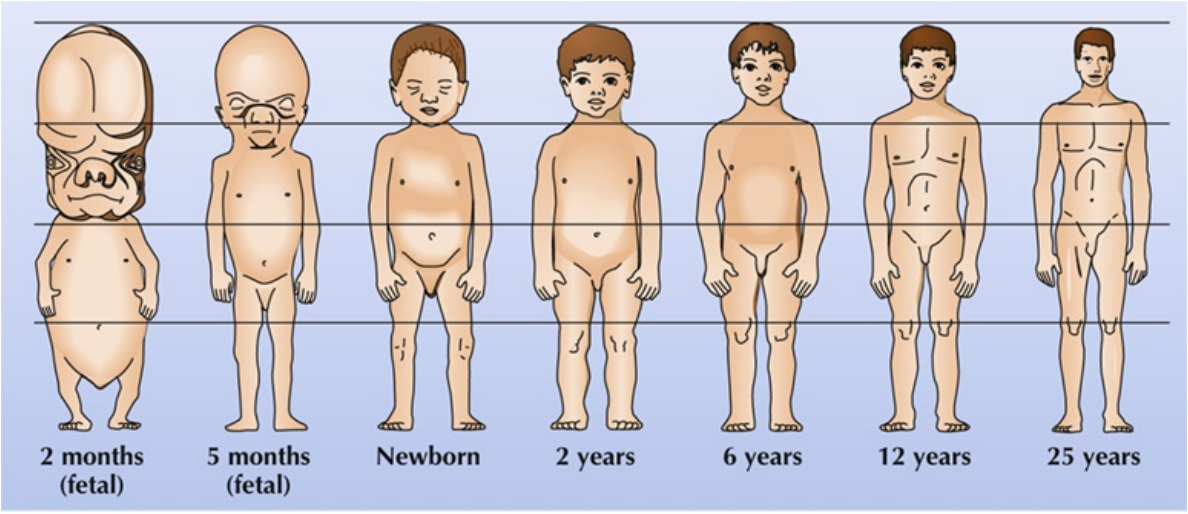
4.2 Psychology Around Us | Positive Psychology

Building Better Futures by Building Better Brains

Scientists now know that early experiences—both good and bad—alter the development of the brain's architecture. We also know that gene expression can be changed by environmental factors. Scientists also know that brains are built from the bottom up. That is, complex circuits and skills are built on more basic circuits and skills, creating either a strong or a weak foundation for future learning. Finally, scientists also know that brain plasticity decreases over time; once circuits are stabilized, they are difficult to modify (Shonkoff, 2016). There is therefore no doubt that the quality of the environment is crucially important in the early years (Benzies et al., 2019). Infants and children exposed to extreme, ongoing levels of intolerable stress experience changes in brain anatomy that place them at risk for increased susceptibility to physical and mental illness.

So, how does this important message about building better brains get to the public? In Alberta, a dedicated group of researchers at the Alberta Family Wellness Initiative is asking just that question. Influenced by Harvard's National Scientific Council on the Developing Child and the Frameworks Institute, they have developed a "core story" about development. This story uses language that is easily understood by anyone—whether they have a background in science or not. For example, the story talks about bidirectional communication between a parent and infant as "serve and return," likens executive functioning to "air traffic control in the child's mental airspace," and refers to intolerable stress as "toxic."

To watch two short but powerful videos designed to convey the important message about the role of early experience in brain development, go to www.albertafamilywellness.org and search for "How Brains are Built: Introducing the Brain Story" and "Brain Hero."



Aynur_sib/Getty Images

FIGURE 4.5 Cephalocaudal pattern The proportion of the head to the rest of the body changes as we develop. Two months following conception the fetal head is almost half the size of the fetal body. In infancy the head is about one-fourth the size of the body. By the time we reach adulthood the head is one-eighth the size of the body.

Infancy is a time of remarkable change in the brain. Two key processes are responsible for the amazing growth of the brain in the earliest years of life. The first is a sheer increase in connections among *neurons*, the brain's nerve cells. As we described in Chapter 3, information is passed from neuron to neuron at transmission points called **synapses**. Born with 86 billion neurons, the infant acquires synaptic connections at a staggering rate, expanding from approximately 2,500 such connections per neuron at birth to around 15,000 per neuron by age 2 or 3 years (Herculano-Houzel, 2014).

synapses transmission points between neurons.

As babies, we actually develop far greater numbers of synapses than we will eventually need. As we grow older, two-thirds of our early synaptic connections disappear (Huang et al., 2015; Zelazo & Lee, 2010). Our experiences help to stimulate and strengthen some synaptic connections, while synapses that are not used weaken and disappear (see Your Brain and Behaviour 4.1). This process of reducing unnecessary connections is called **synaptic pruning** because of its similarity to pruning, or cutting away, the dead branches of a tree or bush to help the healthy, live branches flourish (Hong, Dissing-Olesen, & Stevens, 2016).

synaptic pruning developmental reduction of neuronal connections, allowing stronger connections to flourish.

FIGURE 4.6 Brain growth in the first two years This illustration depicts the increases in the complexity of neurons that occur over the course of infancy.

Another neural process that accounts for increased brain growth is **myelination**. Recall from Chapter 3 that myelin is a fatty white deposit that forms around and insulates portions of many neurons, facilitating the passage of electrical impulses through a neuron more (Stadelmann, Timmler, Barrantes-Freer, & Simons, 2019). During infancy, a great deal of myelination occurs in the spinal cord and in areas of the brain primarily associated with movement, reflexes, sensory responses, and certain low-level learning processes (Özkan, Taşkent, & Teke, 2019).

myelination development of fatty deposits on neurons that allow electric impulses to pass through neurons more efficiently.

Senses

The senses of taste, smell, and touch are all highly developed at birth. A baby can distinguish the scent of his mother's breast milk from another woman's breast milk (Marin, Rapisardi, & Tani, 2015) and can make fine distinctions between various tastes after only a few days out of the womb (Witt, 2019).

Other senses are less developed. Immediately following birth, hearing is somewhat immature and affected by amniotic fluid or vernix in the ear canal. These limitations change

quickly, however. Within a few days the baby can distinguish familiar speech from new sounds and words that they have not heard before (Werner et al., 2011). However, because hearing is so crucial to social development, it is important to identify infants with hearing difficulty as quickly as possible. Work by Martyn Hyde (2016) at the University of Toronto indicates that special efforts taken to screen young infants for hearing issues allows for timely and appropriate interventions to ensure that hearing losses have a minimal effect on development. Indeed, Fitzpatrick et al. (2014) analyzed 20 years of data gathered from the Children's Hospital of Eastern Ontario both before and after implementation of a newborn hearing program. Prior to screening, the median age for the identification of hearing loss was 5 years of age; following program implementation, the median age for identification was 0.8 years.

4.1 Your Brain and Behaviour

Growing from Infancy to Adolescence

Although all brain regions have already started to form before a baby is born, we can tell by their limited abilities and dependence on others that they still have a long way to go. The production of new nerve cells or neurons continues to occur in several brain regions, including those important for learning and memory, throughout infancy, childhood, and beyond.

Somewhat surprisingly, many of the neurons and connections that formed during early development are lost during the postnatal period. Neurons that fail to make appropriate connections die and connections that are not strong enough are eliminated. The death of neurons and elimination of connections play an important role in sculpting the circuitry that develops into a fully-functioning mature brain. And last but not least, the insulation of nerve fibres by the myelin sheath, produced by non-neuronal cells called glia, continues throughout childhood and into young adulthood. This process enables brain regions to send information more quickly and efficiently—its completion during young adulthood coincides with more mature cognitive abilities.

Questions

How do changes in the prefrontal cortex help explain infants' enjoyment of hide-and-seek games?

Improvement in which skills is most directly related to the development of the cerebellum during childhood?

Explain how the sequence of brain development contributes to the finding that adolescents tend to make more impulsive decisions than adults do.

Mike Kemp/Getty Images

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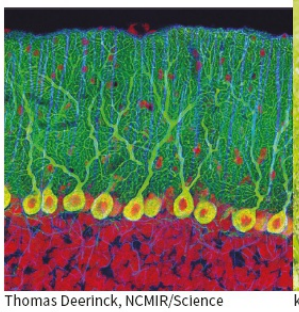
mavoimage/123RF

Playing peek-a-boo Around 9 months, synapses in the pre-frontal cortex are eliminated. The prefrontal cortex is a brain region that is important for cognitive processes like short-term memory. This reduction in the number of synapses seems to coincide with the ability to hold a memory of an object while it is out of sight. Around this time, babies seem to delight in playing peek-a-boo.

kali9/Getty Images

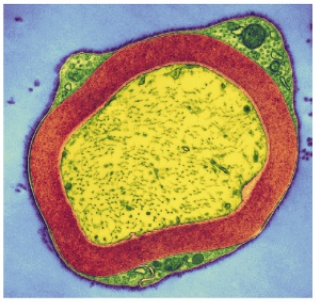
Walking, running, kicking Postnatal neurogenesis occurs in the cerebellum, a brain region important for coordination of movement and certain types of learning. The continual addition of new neurons to this brain region after birth and into childhood may participate in the emergence of motor skills such as walking, running, and kicking a ball.



Thomas Deerinck, NCMIR/Science Source Images

fotostorm/Getty Images

Making better decisions During adolescence, more myelin (see red in photo) forms in the prefrontal cortex. Myelin levels develop earlier in other brain regions, making the prefrontal cortex the latest brain region to reach maturity. The prefrontal cortex is important for moral reasoning, decision making, and planning. The late development of this brain region may explain why teenagers often seem to lack the ability to make good decisions about the future!



Thomas Deerinck, NCMIR/Science Source Images

TABLE 4.3

Common Newborn Reflexes

Reflex	Stimulation	Response	Function
Rooting	Touch the corner of the infant's cheek	Infant turns toward the stimulation and begins to suck	Helps infant begin feeding
Grasping	Press finger against infant's palm	Infant grasps finger and holds on	Allows infant to hold onto caregiver for

			safety
Moro	When infant is lying flat on a blanket, slap the blanket sharply on either side of the head to startle the infant	Infant flings arms outward and then inward in a hugging motion	May help infant to hold on to caregiver when support is lost
Babinski	Stroke sole of infant's foot	Toes spread apart	Unknown (but its presence indicates the integration of the nervous system)

Vision is a baby's least developed sense (Bedinghaus, 2010; Maurer & Lewis, 2014). Newborns cannot clearly see objects much more than 20 or 25 centimetres away. Similarly, their ability to scan objects is limited and they have poor colour discrimination until they are 3 months of age (Cohen & Salapatek, 2013). At first, these visual limitations do not have serious consequences; after all, babies do not travel very far, and they can see far enough to make eye contact with their mothers while nursing. Research by Daphne Maurer and Terri Lewis (2014) at McMaster University tells us much about the rate at which infants' visual skill develops. At birth, an infant's vision is about 20/400 or 20/800; that is, the level of detail that an adult can see at 400–800 feet (122–244 m) a baby can only see at 20 feet (6 m). Interestingly, their vision improves steadily, and by the time infants are about a year old their vision is almost adult-like, although it doesn't reach 20/20 until about 4 years of age (Cohen & Salaptek, 2013).

Reflexes

In addition to our senses, we are also born with certain **reflexes**, programmed reactions to certain cues that do not require any conscious thought to perform. For example, babies pucker their lips and begin to suck whenever something brushes their cheeks or is put in their mouths, a response called the *rooting reflex*. Other common reflexes are listed in **Table 4.3**. Being automatic, reflexes do not tell us much about infants' current ability levels. However, reflexes do allow us to see whether the nervous system is appropriately wired and working the way it is supposed to be working (May & Keros, 2017).

> **reflexes** programmed physical reactions to certain cues that do not require any conscious thought to perform.

For this reason, checking reflexes is an important part of early infant developmental assessments (see photo).

mikanaka/Getty Images

Babinski reflex When the sole of an infant's foot is stroked, the toes spread apart. This characteristic response is a sign of neurological health until a child is about 2 years of age. However, if present in children older than 2 years of age, it may indicate an injury or disease to the brain or spinal cord.

Movement

By the end of their first year, most babies are up and moving. **Motor skills**, the ability to control bodily movements, include achievements such as grasping objects, crawling, and eventually walking. **Table 4.4** shows the typical ages at which children in Canada and the United States reach particular motor-development milestones. As we noted earlier in the chapter, most babies acquire motor skills in roughly the same order, which suggests that there may be a maturational explanation for the way in which they unfold (Haywood & Getchell, 2019).

motor skills the ability to control bodily movements.

At the same time, and as Table 4.4 also shows, there is considerable variability regarding when a child reaches a particular milestone. In addition to genetic variation, the timing of motor development can be influenced by a number of environmental factors.

Negative influences, such as abuse, neglect, or poor nutrition, can slow a child's motor development. Cultural practices that either encourage or discourage early motor development can also influence the timetable. For example, the Kipsigis people in Kenya begin encouraging babies shortly after birth to sit up, stand, and walk (Super, 1976). As a result, Kipsigis children achieve these milestones about a month before children raised in North America. On the other hand, the Ache parents in Paraguay worry about their children moving more than a few feet away, and they actively discourage independent motor development in their children. As a result, Ache children do not walk until an average of one year later than children in North America (Kaplan & Dove, 1987). There are no indications that these differences translate into significant differences later in life. Esther Thelen and others (McCafferty, 2016; Thelen & Smith, 2006) have shown that motor development does not occur in isolation, but rather occurs as a number of complex systems

blend to work synergistically. This *dynamic systems approach* is due to a number of factors coming together, including the environmental support provided for the skill.

TABLE 4.4

Milestones in Motor Development

Motor Milestone	Average Age Achieved	Age Range
When prone, lifts chin up	2 months	3 weeks–4 months
Rolls over	2 months	3 weeks–5 months
Sits alone	7 months	5–9 months
Crawls	7 months	5–11 months
Stands holding furniture	8 months	5–12 months
Stands alone	11 months	9–16 months
Walks alone	11 months, 3 weeks	9–17 months
Walks up steps	17 months	12–23 months

Based on Laura E. Berk, *Infants, Children, and Adolescents*, 6e (Boston: Allyn & Bacon, 2008) Table 5.2, p. 188.

How Does the Body Grow During Childhood?

Growth during early childhood, which lasts from about the ages of 2 to 6 years, and middle childhood, which lasts from about age 6 until 12, is not as dramatic as it is from conception through to the second year. During early childhood, we grow only about 5 to 7 centimetres a year. We do however master a good deal of motor and physical control during this period. Younger children develop basic control over bodily functions, and they solidify a preference for their right or left hand for most tasks (WHO Growth Charts for Canada, 2014).

As children move from early into middle childhood, around age 6, there is a jump in coordination and skill. Children's motor abilities improve dramatically as they gain coordination, agility, and strength (Drummond, 2011). At the same time, the first major physical distinctions between boys and girls begin to appear. Girls experience a growth spurt in height and weight during their tenth or eleventh year, while boys have to wait a couple of years more for their growth spurt. On the other hand, boys develop somewhat more muscle mass, meaning they can throw and jump a little farther and run a little faster. Girls tend to be a bit more agile on average. As we will see later in the chapter, these average sex differences in childhood become much more pronounced as children move into adolescence (Bolger et al., 2018).

Throughout early and middle childhood, the brain becomes more efficient due to a continued combination of the myelination and synaptic pruning that began in infancy. During childhood, myelination is concentrated in the brain areas known as the *association regions*. These areas of the brain coordinate the activity and operation of other regions of the brain, such as putting together sensory information so that we connect what things look like with what they sound like, feel like, or taste like (Bartzokis et al., 2010). As they

become myelinated, the increased efficiency of the association regions leads to more sophisticated planning and problem-solving abilities.

As we discussed earlier, synaptic pruning helps solidify the neural connections that are most beneficial to the child. As childhood draws to a close, pruning slows and both the numbers of synaptic connections between particular neurons and the overall electric activity in the brain begin to stabilize.

Cognitive Development

In just two short years, humans proceed from reflexive, speechless babies who are completely dependent on others to active, talking, walking, problem-solvers. What happens during this period of time that triggers such rapid skill development? We will talk about how we learn language in Chapter 9. Here, we discuss the important changes in thinking ability that happen during those first two years.

Piaget's Theory

One of the world's most influential developmental psychologists, Jean Piaget, focused on **cognitive development**, that is, how thinking and reasoning changes through the active manipulation and exploration of the environment (Piaget, 1985, 2000, 2003). Piaget's theory began with naturalistic observations of children, particularly his own, in real life situations. On the basis of his observations, Piaget hypothesized that young children's thinking processes might differ from those of adults. He then proceeded to test his hypotheses by making small changes in the children's situations and watching to see how they responded to those changes (Piaget, 1981). Based on the results of these tests, Piaget developed a theory of how children acquire knowledge and the abilities to use it (Siegler, 2016).

> **cognitive development** changes in thinking that occur over the course of time.

According to Piaget, all people have mental frameworks or structures for understanding and thinking about the world. He called these frameworks **schemes**, and he believed that people acquire and continuously build their schemes through their experiences in the world. For example, children may acquire a scheme about birthday parties, based on their experiences. When they go to another birthday party, they can predict that there will be presents, some food, a cake, activities, and possibly a treat bag to take home at the end of the party.

> **scheme** Piaget's proposed mental structures or frameworks for understanding or thinking about the world.

Piaget believed that when children gain new knowledge, their schemes change. This change in schemes can happen in two ways. The first, **assimilation**, was defined by Piaget as the inclusion of new information or experiences into pre-existing schemes. For example, imagine a 3-year-old girl, with a St. Bernard dog at home, going to the zoo for the first time. When taken out to see the animals, she is initially confused by the "HUGE dog" they have in the enclosure. In fact the huge "dog" is a bear, but the child *assimilated* the bear to her

existing scheme for larger four-legged furry things (dogs); calling all four-legged creatures "dogs" is assimilation.

> **assimilation** one of two ways of acquiring knowledge, defined by Piaget as the inclusion of new information or experiences into pre-existing schemes.

On the other hand, sometimes we come across new information so different from what we already know that we cannot simply add it to our old schemes. We must alter a pre-existing schema significantly to fit in new information or experiences or create an entirely new scheme, an adjustment Piaget called **accommodation**. With expanding experience, children can *accommodate* and expand or add to their schemes. So, the 3-year-old will create a new four-legged scheme of "bear" to go alongside her existing scheme of "dog."

> **accommodation** one of two ways of acquiring knowledge, defined by Piaget as the alteration of pre-existing mental frameworks to take in new information.

According to Piaget, engaging in assimilation and accommodation helps us to reach a mental balance, or **equilibrium**. When things are in balance, children (and adults too for that matter) are comfortable and able to assimilate new information. When things are not in balance, children experience disequilibration and are in a state of cognitive discomfort. They experience discomfort because they realize that their current schemes will not suffice and are therefore forced to modify their existing schemes to fit new information. Once they are cognitively comfortable, they move back toward equilibrium and are able to assimilate once again.

> **equilibrium** balance in a mental framework.

Piaget's theory is a stage theory. He believed that there were important differences between the thinking of children and the thinking of adults. He suggested that we move through several stages of cognitive development over the lifespan, progressing from having only reflexes as babies to being able to perform complicated mental feats of logic as teenagers and adults. Piaget believed strongly that, as we move from stage to stage, *qualitative* shifts occur in our thinking. Children in one stage not only know more, but actually become different kinds of thinkers than they were at earlier stages (Siegler, 2016). **Table 4.5** shows the four developmental stages and age ranges proposed by Piaget (1981). He proposed that, during infancy, we are in the earliest, or sensorimotor, stage.

Piaget's Sensorimotor Stage

Piaget named the first stage the sensorimotor stage because he thought that, early on, babies can think only about the world in terms of what they can sense directly or manipulate using simple motor actions. For example, a ball, a favourite toy, or a person is present only insofar as the baby can sense it directly or engage with it in some way—for infants, objects are primarily graspable or suckable. If they lose sensory contact with an object, they cannot hold the idea of the object in their mind. For example, if the baby is playing with a ball and it rolls under the couch, once the ball rolls under the couch, it's

gone; out of sight is out of mind.

TABLE 4.5

Piaget's Four Stages of Cognitive Development

Stage	Age	Description
Sensorimotor LWieck/Getty Images	Birth to age 2	Infant or toddler uses senses and motor skills; initially has no thought beyond immediate experience but eventually develops object permanence. Example: Babies enjoy games like peekaboo once they realize that people and objects continue to exist even if they can't see them.
Preoperational monkeybusinessimages/ Getty Images	Age 2–7	Although children cannot yet perform "operations" they are able to hold representations or ideas of objects in imagination. They are unable to consider another's point of view when it is different than their own (egocentric) or to understand that not all things that move or look "alive" are living (animistic). Example: Children may believe that a doll experiences hunger.
Concrete operational monkeybusinessimages/ Getty Images	Age 7–11	Child can now operate on concrete objects and so they can think logically about complex relationships (cause and effect, categorization) and understand conservation. They are unable to think abstractly or hypothetically. Example: Children in this stage begin to question concepts like Santa Claus or the tooth fairy.
Formal operational dbtravel/dbimages/Alamy Stock Photo	Age 11 on	Adolescent can think abstractly and hypothetically. Example: Adolescent can now engage in scientific experiments.

Piaget thought that much of our early learning happens as a result of our reflexes. He observed that even though reflexes are "hardwired" into infants, they are susceptible to

change. Thus, as babies engage in reflexive behaviours, they get feedback about how those responses affect them and the world surrounding them. For example, the rooting reflex often brings food to a hungry infant, while the grasping reflex allows for basic manipulation of objects. In this way, babies acquire knowledge that contributes to the formation of early schemes.

Piaget believed that a major cognitive milestone of the sensorimotor stage is the development of **object permanence**, developing at around 8 months of age (although he did not believe that infants obtained full object permanence until much later). Object permanence is the realization that objects continue to exist even when they are out of a baby's immediate sensory awareness (see photos). At a particular point in development, a child may cry when a toy rolls under the couch because the child knows it still exists but it is now frustratingly out of reach, for example. When children begin to demonstrate awareness of things out of their immediate sensory awareness, it suggests that they are beginning to hold concepts in mind. That is, they have developed mental schemes of those objects—they can form mental **representations** of objects they cannot currently see or touch.

> **object permanence** an infant's realization that objects continue to exist even when they are outside of immediate sensory awareness.
>
> **representations** what results when a person has the ability to understand symbols (such as words) and to think about objects and events as mental entities.

Eventually, babies become able not only to hold objects in their minds, but also to manipulate and make predictions about those objects and how they interact with other objects. A baby may try to lift a cloth to look under it for a hidden toy, for example, or play peek-a-boo with a mother hiding behind her hands. By the end of the sensorimotor stage, Piaget believed that the young child's schemes change from needing a direct experience of the world to one in which ideas and concepts stand in for those objects.

Doug Goodman/Science Source Images

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Out of sight, out of mind **Prior to 8 months of age, babies have no recognition of object permanence. For example, here a young infant stares fixedly at a stuffed animal, but displays no awareness that the toy continues to exist after an**

experimenter hides it from sight.

Piaget's Preoperational Stage

According to Piaget, as children move into the **preoperational stage**, which lasts between the ages of 2 through 7, they become able to hold memories, or representations, of objects in their imaginations and to work with them as ideas (Bialystok & Craik, 2010; Müller & Racine, 2010). This way of thinking represents a dramatic shift from the earlier sensorimotor stage in which they were able only to manipulate actual objects. The thinking of children at this stage still shows some limitations compared to adult thinking, however.

> **preoperational stage** according to Piaget, a developmental stage during which children begin to develop ideas of objects in the external world and the ability to work with them in their mind.

One major limitation is what Piaget called *irreversibility*. Although children in this stage can work with symbols and concepts (representations) that stand in for real-world objects, children at the preoperational stage still think in rather simplistic ways about the relationships between those concepts and objects. For them, changes in relationships happen in one direction only. One researcher offers the following classic example of a 4-year-old boy who was asked about his family:

"Do you have a brother?"

"Yes."

"What's his name?"

"Jim."

"Does Jim have a brother?"

"No."

(Phillips, 1975)

The boy is able to hold the idea of his brother Jim in his head, even though Jim is not there, indicating he has developed object permanence. At the same time, he has adopted this concept in one direction only: Jim is *my* brother. The boy is unable to think about the reverse relationship—that he is Jim's brother also (see photo).

vitapix/Getty Images

Egocentrism and perspective-taking **A child in the preoperational stage may acknowledge that he has a brother, but not yet realize that this means that he himself is also a brother.**

The reason this child cannot think of himself as Jim's brother, according to Piaget, is because he cannot take Jim's point of view, an inability Piaget referred to as **egocentrism** (Kesselring & Müller, 2010). Piaget did not use the term *egocentrism* to mean the boy is arrogant or self-centred; his use of the term refers strictly to children's flaws in logical reasoning. This boy cannot yet realize that he, himself, is also a brother. Piaget believed that this type of *perspective-taking skill*, the ability to take another person's point of view, is not mastered until the next, concrete operational, stage.

egocentrism flaws in children's reasoning based on their inability to take another person's perspective.

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Shapes can be misleading **In the classic test for conservation, a child is shown two identical short thick glasses, each filled with liquid. The child then watches as the liquid from one glass is poured into a tall thin glass and is asked to indicate which glass now has more liquid. Most children between 2 and 7 years incorrectly pick the tall thin glass.**

Irreversibility is also related to a lack of **conservation**, the ability to understand that something can stay the same even though its appearance changes. Piaget used a now-famous task to demonstrate young children's problems with conservation. He gave a child two identical beakers with equal amounts of water in each and asked which of the beakers held more water. Children over 2 years of age were usually able to say that both beakers held the same amount. Piaget would then ask the child to pour the water into two new beakers that were shaped differently, one shallow and wide and the other tall and narrow. After the children poured the water, Piaget again asked which held more water. Children between the ages of 2 and 7—even after they themselves had poured the water into the new beakers—were more likely to say the tall, narrow beaker held more water. Piaget believed this indicated that the children could not mentally reverse the pouring of the water to imagine that the two amounts of water would once again match if both were returned to their original containers (see photos). In addition, Piaget believed the children could not see that, logically, it was still the same water just in a different container, or that the new container was taller but also narrower than the previous container.

conservation the understanding that certain properties of an object (such as volume and number) remain the same despite changes in the object's outward appearance.

Children's lack of conservation also may be related to difficulty in making distinctions between *appearance* and *reality*. In one classic example of this confusion, researcher Rheta De Vries (1969) allowed children to play with her cat, Maynard. After a while, De Vries and her assistants hid Maynard's front half from view while they strapped a dog mask onto the cat's face. (We have no idea how she got a cat to tolerate wearing a dog mask.) DeVries then asked the toddlers what kind of animal Maynard was. Even though Maynard was never completely out of view, the majority of the 3-year-old participants, and a good number of 4- and 5-year-olds, thought the cat had magically become a dog (see photo). By the age of 6, when they were nearing the concrete operational stage, none of the children made this mistake. The younger children could not look past the surface appearance of the masked cat to see that in reality it was still a cat and not a dog. For these preschool children, appearances were the only reality they could conceive of.

Piaget's Concrete Operational Stage

During the **concrete operational stage**, lasting from age 7 through 11 or 12, children demonstrate the ability to think about ideas. School entry coincides with the development of the logical cognitive skills that Piaget called **operations**, the ability to hold an idea in mind and manipulate it mentally. Piaget considered this to be a significant change in thinking, because children in this stage show that they are capable of applying simple logic to their thinking. They start to talk with confidence about complex relationships between

variables, such as cause and effect and categorization. They can take others' perspectives and reverse (mentally undo) operations or actions, as in conservation tasks. By now, they consider the notion that a cat can mysteriously become a dog ridiculous. They know dogs and cats fit into certain hard and fast categories, and they can now extend those categories to other organisms that share the same features.

concrete operational stage Piagetian stage during which children are able to talk about complex relationships, such as categorization and cause and effect, but are still limited to understanding ideas in terms of real-world relationships.

operations Piagetian description of children's ability to hold an idea in their mind and mentally manipulate it.

dmbaker/Getty Images/KrissiLundgren/Getty Images

Appearance versus reality **Younger children have a harder time looking beyond the dog mask to understand that the cat is still a cat.**

Children at this stage show a mastery of real-world relationships. This mastery is limited to physical objects, actual people, places, or things children have observed. This is why Piaget referred to this stage as the *concrete* operational stage. Children in this stage have difficulty with abstract relationships between objects that do not exist in the real world, such as abstract mathematical relationships or logical questions, such as how many unique combinations can be made from four different things. They also find it difficult to think about hypothetical, alternate possibilities and have trouble speculating on questions such as, "What ways can this situation play out?" A mastery of those kinds of relationships is left for the next stage of development, the formal operational stage.

Piaget's Formal Operational Stage

Piaget suggested that at around the age of 11 or 12 years, we cross over into mature adult thinking processes, a final stage known as the **formal operational stage**. Piaget believed

that the hallmark achievement of this stage is the ability to think about ideas conceptually without needing concrete referents from the real world. Older children and adolescents can now reason based on hypothetical concepts, engaging in hypothetico-deductive reasoning. In this type of thinking, individuals begin with a hypothesis, or prediction, and then deduce logical, testable interpretations arising from the hypothesis. They then systematically test variables in isolation or in combination to see which of their theories are correct.

> **formal operational stage** Piaget's final stage of cognitive development when children achieve hypothetical deductive reasoning and the ability to think abstractly.

The successful transition to the formal operational stage means that older children and adolescents are no longer bound by the concrete realities of their world. They can conceive of other worlds and other possible realities, even ones that exist outside their own imaginations, engaging in propositional thought—that is, evaluating the logic of statements (propositions) without considering reality. For example, consider the logic of the following statements. If you assume the first statement is correct, is the second statement also correct?

> *All dogs can fly*.
>
> *Your dog Rex can fly*.

What is the correct answer? Although flying dogs are contrary to reality, a formal operational thinker treats the problem abstractly and is therefore able to correctly answer, "*Yes, my dog Rex can fly*." A concrete thinker would experience difficulty with the problem because it violates what they know to be factually true in the real world.

By adjusting their approaches to focus more on children's capacities rather than on their ability to manipulate objects or events, information-processing researchers have found that cognitive development may involve fewer qualitative shifts (and more quantitative growth) than Piaget believed. Nevertheless, Piaget's ideas remain influential. In addition, Piaget's theory continues to encourage developmental psychologists to generate research that seeks both to support the theory and to rebut it. If nothing else, the intense research activity ignited by Piaget's ideas has helped us think about how to best study children's thought processes. Perhaps most importantly, Piaget encouraged psychologists to stop thinking of children as organisms programmed by biology or by early experiences, and instead to think of them as active interpreters of their world.

Evaluating Piaget: Information Processing Views of Cognitive Development

Piaget has often been criticized for looking at what children could not do and then using their mistakes to determine their cognitive abilities. Today, however, psychologists who adhere to the **information-processing theory** study how children learn, remember, organize, and use information—they look to see what children *can* do, as opposed to what they cannot do. Such theorists have found that Piaget probably underestimated children's competencies in the various developmental stages (Bjorklund & Causey, 2017; Li, 2010).

> **information-processing theory** a developmental theory focusing on how children

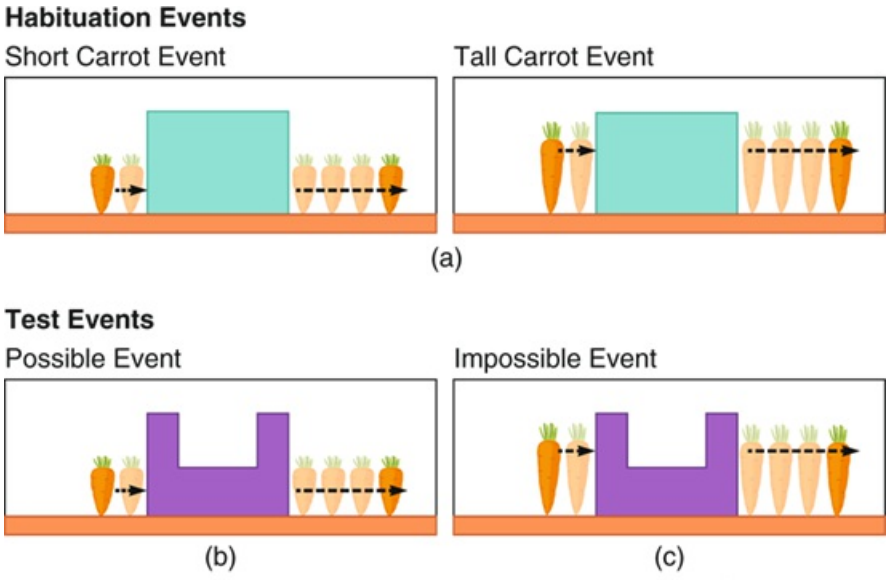
learn, remember, organize, and use information from their environment.

To see whether a baby developed object permanence, for example, Piaget would hide an object under a cloth and see whether the baby looked for it. Searching for the object, by pulling the cloth off the object, suggests that the baby still had the object in her mind. As we have noted, however, it takes some time for babies to master control over their bodies enough to move purposefully and conduct a search. To accomplish the task of retrieving the desired object, you have to carry out two sequential behaviours: you have to pull the obstacle away from the object and then you have to grasp the hidden object. To address this confound, other researchers such as Renée Baillargeon, originally from Quebec, have suggested that a better indicator of object permanence is to observe how babies respond when their expectations have been violated (Baillargeon et al., 2013; Baillargeon, 1987).

To carry out a **violation-of-expectation** approach to test object permanence, Baillargeon and colleagues habituated babies to a particular event. When babies **habituate**, they stop responding over time to the same stimulus if it is presented again and again—they get bored with it. In the violation-of-expectation method, babies are generally habituated to an expected, or possible, event (one that obeys a physical law or scientific generalization see **Figure 4.7**). After the babies show a decline in looking at the expected event, they are shown an unexpected event. When the babies indicate surprise or increase their looking time, the assumption is made that they had a representation of the object. After all, to be surprised, babies had to have had an expectation that was challenged in some way. Such surprise implies that the babies had a mental representation of the situation and that their representations were shown to be wrong. For example, in a now classic violation-of-expectation experiment, Baillargeon and colleagues habituated babies to an expected, possible event, a short or a tall carrot going behind a tall screen and coming out the opposite side. They then violated the babies' expectation with an impossible event; they had the tall carrot go behind the cut-out screen and then had it appear on the opposite side —without being seen through the cut-out screen as it made the crossing from one side to the other. Using expressions of surprise as the evidence that the babies recognized that the object (in this case a carrot) had continued to exist (when it was unseen behind the screen), Baillargeon and colleagues argued that babies as young as 3 months display some form of object permanence (see Bremner, Slater, & Johnson, 2015).

violation-of-expectation an experimental approach capitalizing on infants' and toddlers' heightened reactions to an unexpected event.

habituation the process of habituating, in which individuals pay less attention to a stimulus after it is presented to them over and over again.



Source: Baillargeon, R., & DeVos, J. (1991). Object permanence in young infants: Further evidence. *Child Development*, 62(6), 1227–1246.

FIGURE 4.7 Object permanence In a classic study, Baillargeon & DeVos (1991) used both a habituation event and test event to identify object permanence in infants as young as 3 months of age.

Using this *violation-of-expectation* approach, another group of researchers were able to show that babies understand rudimentary mathematics. As amazing as it may sound, infants may actually be capable of mathematical equations using small numbers! As you can see in **Figure 4.8**, psychologist Karen Wynn conducted a series of studies in which she showed 5-month-old babies a sequence of events where one doll is put in a case behind a screen followed by another doll (Neuman & Nave, 2010; Wynn, 1992, 2002). She found that when the screen was dropped, the babies expressed surprise and looked longer if only one doll was in the case than if both dolls were present. The babies seemed to know that the case should hold two dolls. This result has been replicated with even larger numbers (five to ten dolls) in 9-month-old children!

Many critics have challenged Piaget's belief that children in the preoperational and concrete operational stages have problems taking others' point of view. In fact, some researchers have become very interested in young children's awareness of their own minds and the minds of others, a field of research called **theory of mind** (Tyler, 2015; Frye & Moore, 2014).

theory of mind an awareness of one's own mental states and the mental states of others.

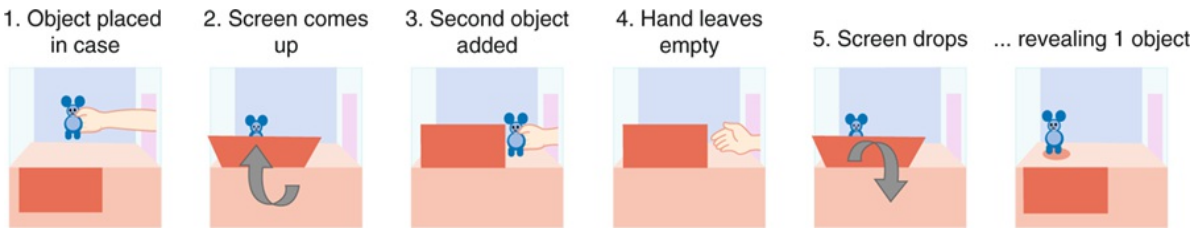


FIGURE 4.8 Baby math To see whether 5-month-old infants have an appreciation of addition and subtraction, Karen Wynn showed them the sequence of events illustrated above. If the infants express surprise when the screen drops and they see only one object, it suggests that they understand that 1 + 1 = 2. Based on Weiten, W. (2007). *Psychology: Themes and variations* (7th ed.). Belmont, CA: Thomson Higher Education. Adapted by permission from Macmillan Publishers Ltd: Nature, K. Wynn, Addition and subtraction by human infants, vol. 358, pp. 749–750, © 1992.

Theory of mind was first studied in an experiment with children between 3 and 9 years of age. Each child participant was told a story about a boy named Maxi who tries to sneak some chocolate from his mother (Wimmer & Perner, 1983). According to the story, Maxi's mother brings home some chocolate to make a cake, and while Maxi is watching, she puts the chocolate in a blue cupboard (see **Figure 4.9**). Maxi then goes out to play. While he is outside, his mother makes the cake and puts the remaining chocolate in a green cupboard. Next, Maxi comes back in, wanting some chocolate. The researchers then asked the children in the study where Maxi would look for the chocolate.

This deceptively simple task actually requires a high level of thought. Children have to not only remember where the chocolate has travelled, but also take the viewpoint of Maxi and realize that Maxi has no way of knowing that his mother moved the chocolate. Three- to 4-year-olds regularly fail such tests, suggesting this task is too complicated for them, while most 4- to 5-year-olds passed the task, and 6-year-olds regularly succeeded. Experiments such as these support Piaget's notion that young children are egocentric or focused on their own knowledge or perspective, but also suggest that children are able to take other people's thoughts and feelings into account much sooner than Piaget had predicted—at around age 4 as opposed to age 6 or 7 years.

Another way that researchers assess theory of mind is to assess children's understandings of *false-beliefs*. False beliefs are based on a premise that is not true; the ability to understand false beliefs usually develops by the age of 5 years (Brandt et al., 2016). Canadian researchers Alison Gopnik and Janet Astington (1988) devised the well-known *Smarties* task to test a young child's understanding of false beliefs. They asked children to guess what was in a *Smarties* box. The children confidently guessed candy, but were then shown that the box was in fact full of small pencils. After the researcher closed the box, they asked the children to guess what they thought a peer who had not yet seen the actual contents of the box would say when asked what was in it. Many 4-year-olds and most 5-year-olds were able to guess "*Smarties*," but some 4-year-olds and most 3-year-olds incorrectly guessed, "pencils." When the children who failed the task were asked why they thought their peer would not guess *Smarties*, they said, "Because it *isn't Smarties*, it's pencils."

In part, Piaget's approach may have been limited by a failure to listen to his own theory. Piaget believed that thought preceded language—that our thinking develops faster than our ability to use words. Yet, his tests of his theories rested on observations of children's performances on language-based tasks, such as the question about Jim's brother. Other researchers, by focusing on non-verbal responses or by making their questions more age-appropriate or child-friendly, have found evidence that children develop certain cognitive competencies sooner; for example, pictures accompanied the story of Maxi. More recent

research has linked theory of mind to general language development (San Juan & Astington, 2017).

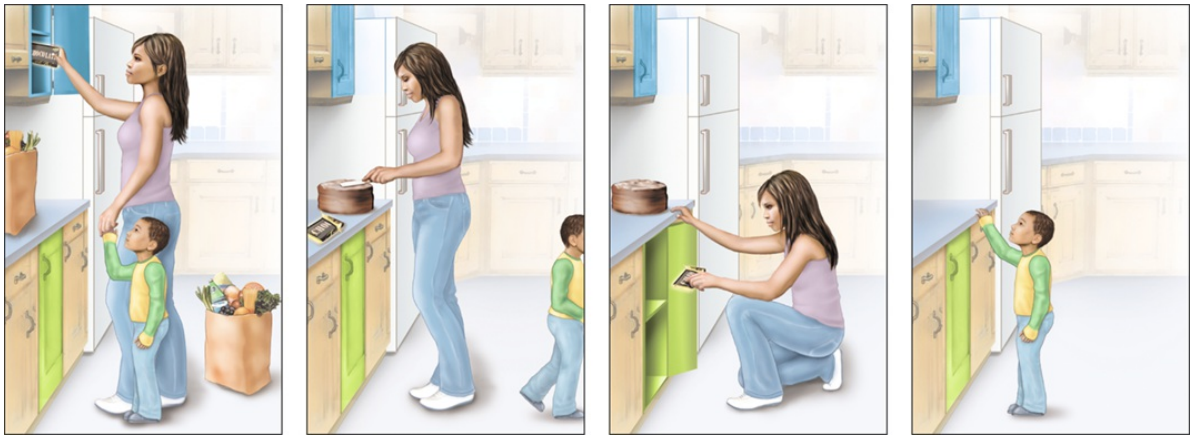


FIGURE 4.9 Theory of mind Young research participants are told a story in which a child first sees his mother place chocolate in an upper cupboard, then he leaves while she makes a chocolate cake. In his absence, the mother places the leftover chocolate in a lower cupboard, and the child then returns looking for leftover chocolate. Participants with a theory of mind recognize that the child in the story will look for the leftover chocolate in the original upper cupboard, because the child is not aware of the mother's switch of locations.

Still other critics, such as Jeremy Carpendale from Simon Fraser University, have charged that Piaget's theory fails to account fully for *social* factors, the influences that other people may have on a child's cognitive development (Carpendale & Lewis, 2010, 2017; Freund & Lamb, 2010). Instead, Piaget's theory focuses on how children guide their own development through experimentation and reflection. Later in his life, Piaget himself also wondered whether his theory said enough about the role of social experiences in development (Inhelder & Piaget, 1979; Piaget, 1972), and indeed his theory underestimated the role of culture in reasoning. As we will see next, a contemporary of Piaget's, Lev Vygotsky, had more to say about social influences on cognitive development.

Alisha Arif / Alamy Stock Photo

False belief task **Children who correctly anticipate that another child will assume that a *Smarties* box contains *Smarties* (even when they know it doesn't) have an understanding of false belief.**

Vygotsky and the Role of Socio-cultural Theory

While Piaget was focusing on how children's private experiments and reflections shape their thinking, a Russian psychologist named Lev Vygotsky was becoming increasingly interested in how social interactions with more mature members of their culture shaped the development of children. Unlike Piaget, who viewed a child's development as a process of individual achievement, Vygotsky (1978, 1991, 2004) believed that constructive interactions with parents, older children, teachers, and siblings helped the child develop ways of thinking about and functioning in the world. In Vygotsky's view, an older mentor, such as a parent, helps the child by initially taking responsibility for the basic skills and capabilities the child is developing. Over time, the mentor takes less and less responsibility. Jerome Bruner (1983, 1986), a Vygotskian researcher, referred to the mentor's step-by-step assistance as **scaffolding**, while Barbara Rogoff (1990) referred to this process as an *apprenticeship in thinking*. Vygotsky labelled the gap between what children can accomplish by themselves and what they can accomplish with the help of others as the **zone of proximal development**.

scaffolding developmental adjustments that adults make to give children the help that they need, but not so much that they fail to move forward.

zone of proximal development the gap between what a child could accomplish alone and what the child can accomplish with help from others.

Because Vygotsky believed that other individuals are critical to helping children develop, he also believed that there is a great deal more variability in how children develop. He believed that each culture has its own specific challenges, and that those challenges change over the course of life, meaning that development has to meet those challenges.

Because of his death at the young age of 37 and the chilly political climate between the former Soviet Union and the West, Vygotsky's ideas have only become widely studied in North America in recent years. However, developmental psychologists have found numerous ways to apply Vygotsky's ideas (Trawick-Smith & Dziurgot, 2011). He has become one of today's most influential developmental theorists (Eun, 2010). Indeed, the ideas of scaffolding and zones of proximal development are now an important part of educational systems throughout North America (Roth & Jornet, 2017; Moll, 2013). When helping children learn to read, for example, many teachers begin by reading books to them, and then gradually turn over responsibility for various reading skills. The children may first follow along with the pictures as the teacher reads the words, then point to letters. Eventually, they learn to read single words, then sentences, and finally entire books on their own, as the teacher provides less and less scaffolding.

Social and Emotional Development in Infancy and Childhood

While we tend to think of young infants as completely helpless, they actually bring a number of behavioural tendencies to their early interactions with their parents.

As we noted in Chapter 1, many psychological researchers are interested in trying to determine how much of the way we think and act is influenced by our genetic inheritance, a field of study called *behavioural genetics*. Developmental psychologists are often in a position to examine the influence of genetics. One of the key areas of focus of both behavioural genetics and developmental psychology, for example, is **temperament**, defined as a biologically-based tendency to respond to certain situations in similar ways throughout a person's lifetime (Trofimova & Robbins, 2016; Chess, 2013). (See photo.) Although temperament and personality are related, they are not the same thing. Many personality characteristics are learned or acquired, whereas temperamental traits are considered genetic (Zentner & Shiner, 2015; Buss & Plomin, 2014). In a longitudinal study that began in the 1950s, the *New York Longitudinal Study*, researchers Stella Chess and Alexander Thomas (1996; Thomas & Chess, 1977) collected data suggesting that, as infants, people tend to fall into one of four temperament categories:

Easy. (40 percent) Babies with easy temperaments are described as cheerful, regular in routines, such as eating and sleeping, and open to novelty.

Difficult. (10 percent) Babies with difficult temperaments tend to be irritable and are likely to have intensely negative reactions to changes or new situations.

Slow-to-warm-up. (15 percent) Babies in this category are less active and less responsive than babies in the other two categories. In general, they tend to withdraw in the face of change, but their withdrawal is not as sharply negative as those with difficult temperaments.

Unique. (35 percent) Babies in this category show unique blends of characteristics from the other categories. For example, a child might be cautious in new situations but have regular routines and be relatively cheerful.

temperament a biologically-based tendency to respond to certain situations in similar ways throughout a person's lifetime.

Lokibaho/iStock/Getty Images

Toddler temperaments **Infant and toddler temperaments can be observed in the typical behaviours they display.**

Following Chess and Thomas's (1996; Thomas & Chess, 1977) studies, many other researchers have also examined how temperament relates to later personality characteristics. Psychologist Jerome Kagan (2010, 2011) conducted a longitudinal study examining the relationship between babies' levels of *behavioural inhibition*, the tendency to withdraw from new or different situations, and levels of shyness later in life. He found that children who were highly inhibited at 21 months of age were more likely than uninhibited toddlers to be shy when they were 12 to 14 years old.

Kagan's research illustrates two key aspects of temperament:

Temperament is inborn. Kagan argues that individual differences in arousal of the amygdala are involved in this aspect of temperament (Fox et al., 2015). The amygdala is involved in avoidance reactions; thus, in inhibited children the amygdala is excited by minimal stimulation, whereas in uninhibited children the amygdala requires a great deal more stimulation to become excited. Other physiological correlates, such as higher heart rates (Schmidt, DeBuse, & Seger, 2007), higher concentrations of the stress hormone cortisol (Zimmerman & Stansbury, 2004), greater pupil dilation, higher blood pressure, as well as EEG activity in the right frontal lobe (Fox et al., 2015) also indicate higher emotional arousal in inhibited infants and children.

Temperament is stable across situations and time. The participants in Kagan's study who were most inhibited temperamentally were the ones who were most inhibited at many different times and in different situations. Researchers have also established that other aspects of a person's temperament are stable over time and place (Bornstein et al., 2015). This is not to say, however, that there is no variability at all from time to time and situation to situation. In fact, investigators have found greater

stability of temperament when measuring behaviour across similar situations, such as in various family situations, than when comparing temperamental influences on children's behaviour across different situations, such as school versus home (Dyson et al., 2015).

Despite the biological factors implied above, it is important to recognize that our environments also play important roles in how we behave. Kagan's earlier studies (Kagan & Snidman, 2004) revealed, for example, that not all of the babies who were inhibited at birth later developed into shy teenagers, suggesting that environmental factors are also important in shaping personality. There is also ample evidence to suggest that both genetics and environment interact to influence behaviour. For example, difficult children with sensitive parents regulate emotion better over time than difficult children with insensitive or inconsistent parents (Chen, Deater-Deckard, & Bell, 2014).

So, both infants and parents bring their temperaments and personalities to their early interactions, and the characteristics of each influences the relationship. We now turn our attention to how those early interactions contribute to relationships as the infant and caregivers begin to form the important attachment relationship.

Attachment

Attachment theorists argue that the relationship between a caregiver and an infant is crucial to the child's long-term social and emotional development (Allen, 2011; Nelson & Bennett, 2008). Researchers have therefore long been interested in determining what fosters attachment. Attachment is defined as a significant and enduring emotional connection that serves as an essential foundation for future relationships (see Indigenous Experiences 4.1).

> **attachment** a significant emotional connection to another person, such as a baby to a primary caregiver.

Freud argued that the infant's emotional tie to the mother formed the foundation for all other relationships, and further argued that feeding was the basis for building this emotional connection. To test Freud's assertion that feeding was at the basis of all mother–infant relationships, Harry Harlow and Robert Zimmerman (Harlow & Zimmerman, 1959) carried out a now famous experiment in the 1950s. Baby rhesus monkeys were removed from their mothers at birth and were reared in isolation for six months with two "surrogate mothers." One "mother" was fashioned of soft terry cloth, whereas the other "mother" was made of wire-mesh. The wire-mesh "mother" held the bottle. Baby monkeys spent almost all of their time clinging to the soft "mother"—only leaving her to go to the wire "mother" when driven to eat. Harlow concluded from the results that the crucial element in forming attachments is contact comfort (see photo).

4.1 Indigenous Experiences

Intentionally Breaking Familial Bonds

"Imagine that you are five years old. A stranger comes to your home village and seizes

you from your mother's arms. Imagine he takes you hundreds of miles away to a place where white people in black robes cut off your hair and take away your clothes, the ones your mother made especially for you. They also take away your name—you get a number instead. They separate you from your brothers and sisters and forbid you to speak to one another in your native language… Imagine being silenced with shouts. Imagine learning that your family traditions and culture are evil and barbaric … Imagine a heavy hand on your shoulder pulling you away from the dormitory in the night. Imagine you're sick, feverish, and alone. Other children also coughing, gasping. Some are dying and you know it, even though they try to cover it up…Think of that. Bear that. Imagine that" (Stromquist & Knickerbocker, 2015, p. 2).

This quote, from The Project of Heart (Stromquist & Knickerbocker), speaks to how colonization sought to break the familial bonds that are so important in Indigenous culture. Gabriell Sagrad, a seventeenth-century missionary, noted that Indigenous peoples "loved their children dearly" (Truth and Reconciliation Commission, 2012, p. 9) and this observation was made by many other missionaries, who also commented on the "close bond between Aboriginal parents and their children" (p. 9). Indigenous children were cherished but were also taught to be self-reliant, respectful, and responsible. Discipline was accomplished largely through example and children were rarely scolded or punished. As settlers began to dominate, many Indigenous parents knew that a Euro-Canadian education would be important if their children were to adapt to the changing circumstances, and they began to express interest in schooling within their communities. Early treaty negotiations promised on-reserve schools and teachers; no mention was made of residential schools (Truth and Reconciliation Commission, 2012).

In spite of this, residential schools were created explicitly to separate children from their families, weakening family ties and cutting children off from the affection and nurturing they deserved and required, as well as ultimately leaving them without the parenting skills to raise their own families, creating lasting trauma from one generation to another. "Two primary objectives of the Residential Schools System were to remove and isolate children from the influence of their homes, families, traditions and cultures, and to assimilate them into the dominant culture" (Harper, 2008, para 2).

In many cases, this assimilative process was successful. Marius Tungilik said that he felt he had been taught "to hate our own people, basically, our own kind" while at school in Chesterfield Inlet. When he returned to Repulse Bay, he saw his community differently: "you begin to think and see your own people in a different light. You see them eating with their hands. You think, 'Okay, primitive'" (Truth and Reconciliation Commission, 2012, p. 79).

"We Were Children" - Feature Film-Courtesy of Eagle Vision.

Residential schools **In 1920 the Indian Act made attendance in residential schools mandatory for all Indigenous children aged 7 to 15 years of age. In 1969 the Department of Indian Affairs took over the system, ending the involvement of churches. By 1986 most schools had been closed or were controlled by local bands.**

An anonymous survivor who attended a residential school in The Pas, in Manitoba, reported, "When I was younger, I learned how to hate, I hated my own mother, I blamed her for allowing us to be taken away even though at that time I didn't realize she didn't have a choice. It wasn't until 1990 that she told us that 'I didn't have a choice. It was either that, or me going to jail. I had to let you kids go to school,' 'cause that's when I disclosed to them both my mom and dad what I went through in residential school" (Name redacted, 2010, p. 57).

Critical Thinking Questions

Why do you think that attempts to assimilate Indigenous children were considered likely to be more effective if the children did not have already established attachments to their parents or other family members?

Indigenous children were taught to be respectful, responsible, and self-reliant and were rarely punished. Which parenting style (see Table 4.6) would best describe this approach to parenting? Why?

Nina Leen/The LIFE Picture Collection/ Getty Images

Contact comfort **Infant rhesus monkeys showed clear preference for the soft "mother" over the wire "mother."**

A former student of Freud's, Erik Erikson (1959, 1984, 1985), developed a psychosocial stage theory of development to describe the impact of social development across the lifespan. Erikson believed that individuals had to develop a particular social competency—or *psychosocial strength*—at each of eight stages in the lifespan. In the first stage, Erikson argued that, because they are completely dependent and vulnerable, infants in the first year of life need to develop trust (*trust versus mistrust*). When infants develop a sense of trust, they learn that others can be counted on to meet their needs and desires; however, when they develop a sense of mistrust, they view others as unreliable, inconsistent, and unpredictable. Erikson viewed trust as the foundation of human development. He argued that viewing others as safe and dependable leads to the enduring belief that the world is a secure place. Erikson believed that appropriately responsive and sensitive parenting contributed to the development of trust whereas rejecting or harsh or inconsistent parenting leads to the development of a sense of mistrust. As children become toddlers they move into Erikson's second stage of psychosocial development, *autonomy versus shame and doubt*, they learn to act on and express their own desires as they begin to resist adult authority; if unsuccessful at this task, they begin to doubt their own assertions. By preschool, in the stage of *initiative versus guilt*, children develop a sense of purpose or conversely may feel inhibited by fear of censure or punishment. In middle childhood, the elementary school years, children are in Erikson's fourth stage where they develop a sense of industry or inferiority—here they develop either a sense of competence or inadequacy (see photos). We will look further at Erikson's theory later in the chapter.

HONGQI ZHANG/123 RF

Early attachment **The formation of a positive early attachment to a caregiver is frequently associated with emotional and cognitive well-being over the young child's lifespan.**

The ethological perspective of British psychiatrist John Bowlby asserts that human beings are born with a drive to form an attachment, to become emotionally close to one particular caregiver, usually their mother. He suggested that early positive experiences with that caregiver are critical to health and well-being, and they shape how well the individual will function emotionally, socially, and even cognitively later in life (Bowlby, 1969, 1999; Crittenden, 2017).

Bowlby also argued that the behaviours of infants are aimed at bringing them closer to their mothers. He believed, for example, that reflexes such as rooting or reaching out help babies to build relationships with their mothers (Bowlby, 1958). To Bowlby, the presence of these reflexes provided evidence that attachment processes are inborn and crucial to the survival and well-being of babies. Bowlby also thought that children with strong attachments to their mothers would actually feel safer than children who were more independent and less attached to their mothers. Indeed, he suggested that appropriate, consistent responsiveness to a baby's needs is actually the best way for a mother to eventually bring about an independent and well-functioning child. Initially, the scientific community reacted negatively to this assertion (Holmes, 1993). The psychological wisdom of Bowlby's day held that parents who respond to children's needs in this way would only succeed in promoting neediness and dependence; however, we now know that sensitive caregiving in infancy is crucial to the development of appropriate emotional expression and emotional regulation (Perry, Blair, & Sullivan, 2017).

pictrough/123 RF

Mothers versus fathers **Although Bowlby focused on the important role of attachment to the mother, research shows that attachment to the father also plays an important role in the lives of children.**

Mary Ainsworth, a colleague of John Bowlby, was one of the first women to earn a Ph.D. in Psychology at the University of Toronto and to take up a faculty position there (in 1939). She went on to work with Bowlby and conducted naturalistic observations in Uganda that supported Bowlby's ideas that mother–child attachment occurs around the world (Ainsworth, 1967, 1985, 1993, 2010). Like Bowlby, Ainsworth argued that babies attach to their mothers in order to meet their needs (Grossman Bretherton, Waters, & Grossman, 2016). Ainsworth further noticed that some mothers, whom she labelled "highly sensitive," seem to form attachments that were more successful in fostering their children's independence.

Ainsworth developed a way to test the attachment between babies and their mothers in a laboratory setting. Ainsworth's procedure, called the *Strange Situation* (see **Figure 4.10**) (Ainsworth et al., 2015; Ainsworth & Bell, 1970), consists of eight, one-to-three minute episodes. The procedure begins when the mother and baby enter an unfamiliar room. The baby plays in a laboratory room with the mother nearby. After a time, a stranger enters the room, speaks with the mother, and attempts to interact with the baby. Then the mother leaves the room. The baby, left alone with the stranger, generally is in mild distress. The mother then returns. The stranger leaves. Then the mother leaves, and the baby is alone. The stranger then returns and offers to comfort the baby (if the baby is distressed). Then the mother returns. The researchers are interested in how willing the baby is to explore when the mother is present but are most interested in how the baby reacts to the mother in the two episodes where she leaves and then returns. This "reunion" behaviour is what researchers are most interested in.

Based on her experimental findings, Ainsworth identified three basic attachment styles:

Secure attachment (60 percent of infants): The infant uses the mother as a secure base

from which to explore and as a support in time of trouble. The infant is moderately distressed when the mother leaves the room and happy when she returns.

Anxious/avoidant attachment (15 percent of infants): The infant is unresponsive with the mother and is usually indifferent when she leaves the room and when she returns.

Anxious/ambivalent/resistant attachment (10 percent of infants): The infant reacts strongly when the mother leaves the room. When she returns, the infant shows mixed emotions, seeking close contact and then squirming away angrily.

Later, psychologist Mary Main noted that some children fail to show any reliable way of coping with separations and reunions, exhibiting features of all three of the other styles (Main, Hesse, & Kaplan, 2005; Main & Solomon, 1990). Ainsworth and Main therefore added a fourth category to describe this pattern:

Disorganized/disoriented attachment (15 percent of infants): The infant displays confused and contradictory behaviour when the mother returns. For example, the infant may ignore the mother while being held, appear flat and depressed, look dazed, cry out, and/or show a rigid posture.

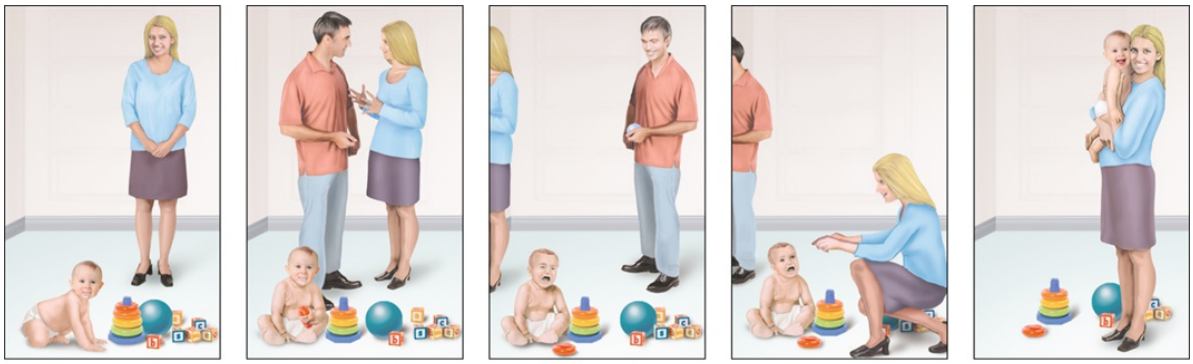


FIGURE 4.10 Abbreviated Strange Situation procedure (a) The baby plays while the mother is nearby. (b) A stranger enters the room, speaks to the mother, and approaches the child. (c) The mother leaves and the stranger stays in the room with an unhappy baby. (d) The mother returns and the stranger leaves. (e) The baby is reunited with the mother.

Figure 4.11 shows the incidence of all four styles.

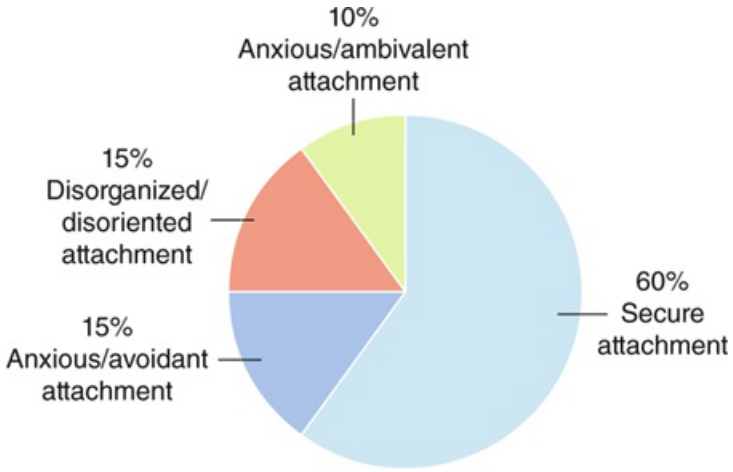


FIGURE 4.11 Styles of attachment Ainsworth and Main identified four styles of attachment.

In 1969, Bowlby suggested that early attachment experiences help people create an *internal working model* of the world, themselves, and the others with whom they form early attachment relationships. If children come to think of themselves as worthy of love and affection, view other people as supportive and responsive, and view relationships as positive experiences as a result of having sensitive mothers, Bowlby suggested that this positive model will influence their later relationships in a healthy way. In contrast, children who develop a working model that they are not worthy of love and affection, view their relationship partner as insensitive, and view their early relationships as negative, may be at risk for poor adjustment or difficult relationships with other people later in their lives.

One of the drawbacks to Ainsworth's work is that she suggests that children are either securely attached or not. This categorical approach does not make it easy to talk about degrees of security or degrees of anxiousness in children's attachment patterns. An alternative approach, called the *Q-sort approach* (Stephenson, 1953), involves observers of parent–child interactions placing descriptions of various attachment behaviours into nine piles, with frequent behaviours at one end and infrequent behaviours at the other. This measure provides a more fluid estimate of the child's general attachment patterns. Heidi Bailey and Elyse Redden, from the University of Guelph, as well as colleagues David Pederson and Greg Moran from the University of Western Ontario have compared both the Strange Situation and Q-sort attachment assessment methods (Bailey et al., 2016a, 2016b). The researchers found that there was much agreement in the ratings of security found using the Strange Situation in a lab setting and the Q-sort in the child's home setting. They also found, however, that the Q-sort technique used in the child's home was more sensitive to child ambivalence (finding it at twice the rate of the Strange Situation method). Given that ambivalence can predict later social adjustment issues, the Q-sort might be the better assessment to use if you are looking to ensure that children and families in need of support are identified (see Practically Speaking 4.1).

The vast majority of attachment research has focused on mothers, and indeed, cultural practice bears out the importance of the mother–child relationship; in almost every society, mothers do the majority of childcare (Konner, 2016). Evidence also indicates, however, that fathers are capable of responding in highly sensitive ways, and that highly sensitive fathers

have babies that generally turn out to be securely attached (Verissimo et al., 2011).

Parenting Styles

Once attachment theory gave psychologists a way of *operationalizing* (or defining in a measurable way) the relationship between parents and children, other researchers began applying those insights to understanding how parent behaviours might contribute to development. For example, Diana Baumrind, a psychologist at the University of California Berkeley, conducted interviews and observations of primarily white, middle-class preschool children and their parents and found that two characteristics of parental behaviour seem particularly important: how many demands the parent puts on the child, and how responsive the parent is to the child (Baumrind, 1991; Baumrind, Larzelere, & Owens, 2010). Combining those two dimensions, Baumrind identified four parenting styles and the child outcomes associated with them, as depicted in **Table 4.6**.

A key question about Baumrind's theory has been how well it applies outside largely white, individualistic cultures. *Individualistic cultures* are those in which people are expected to be self-reliant and self-achieving, while *collectivist cultures* expect people to be focused primarily on the needs of the group. Cross-cultural research on parenting has found that parents in a variety of cultures can be classified into the same four styles. It is not clear, however, that the outcomes of the four parenting styles are the same across different cultures. Research by Xinyin Chen at the University of Western Ontario (Chen et al., 2014; Way et al., 2013) suggests, for example, that in Asian cultures, the high-demand, low-responsiveness, authoritarian parenting style does not necessarily lead to negative child outcomes as it often does in Canada. In fact, the authoritarian style can benefit children's academic performances during adolescence.

4.1 Practically Speaking

Childcare in Canada: How Are We Doing?

The answer to the above question largely depends on a person's level of income. Canadian parents vary widely in their ability to access and pay for childcare in a system characterized by high fees and low access, resulting in inequality of access. "Canada's existing policy architecture is profoundly inadequate for meeting chid, family, women's and social needs," according to two researchers (Prentice & White, 2019, p. 61). Many families are unable to access childcare either because they live in areas where services are difficult to obtain or are entirely absent, often referred to as "childcare deserts," or because they cannot afford the high cost of childcare. In most provinces, subsidies are difficult to qualify for and once obtained often fail to offset a substantial proportion of the cost (Macdonald & Friendly, 2017). These roadblocks to childcare differentially affect minorities, women, and those in lower-income brackets.

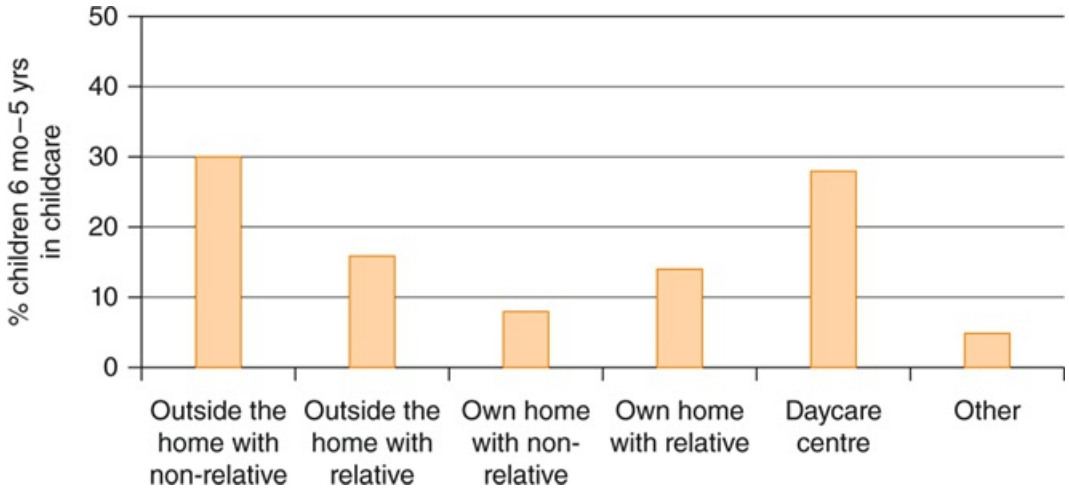
These distributional disadvantages are especially concerning because many Canadian families require childcare in order to work. Although approximately 70 percent of infants are cared for by their mothers during their first year, 86 percent of parents report using childcare on a regular basis (Sinha, 2014).

Also of concern, the quality of care for children in Canada is generally very poor.

Outside of Quebec, service delivery for childcare relies on either voluntary non-profit operators or commercial operators. On the most recent (although dated now) Innocenti Report Card from the United Nations Children's Fund, Canada placed 21st out of 29 countries for general child well-being in childcare. This report card is intended to examine and compare how well Organisation for Economic Co-operation and Development countries do in safeguarding the rights of children. Canada achieved only one of the 10 benchmarks of quality in childcare and early learning (Adamson, 2008).

Unlike countries like Sweden, which provides universal childcare from birth into the school years, Canada currently has no national childcare policy. Some provinces are developing policies and programs to overcome these disadvantages. For example, Quebec has a broad childcare policy and program where many parents can obtain childcare for $7.30–$20 a day (Stalker & Ornstein, 2013). As well, the wages of Quebec childcare workers have nearly doubled from where they were several years ago. This means that a greater number of people are entering the field of early childhood education, investing in higher levels of training and experience in order to enter the profession and thereby ensuring higher quality care for children (Ferrao, 2010). Saskatchewan and Prince Edward Island have moved responsibility for daycare into their education ministries (Akbari & McCuaig, 2014). Other provinces are implementing subsidized programs aimed at improving early childhood education on the belief that additional costs will be offset down the road by the benefits of a healthier, better educated population (Yoshikawa et al., 2013).

But the overarching problem with childcare is that the pattern of social investment in childcare systems in Canada, and other countries such as the United States, privileges those of higher income over those of lower income. A national initiative that ensures quality childcare to all Canadian children is sorely needed.



Childcare in Canada Distribution of children aged 6 months to 5 years by type of main non-parental care arrangement, 2002–2003.

Source: Statistics Canada, Child Care in Canada: Children and Youth Research Paper Series, Bushnick, Tracey (2006) Catalogue no. 89-599-MIE2006003, April 2006, Figure 6, 2002–2003, page 14.

TABLE 4.6

Parenting Styles

Parental Style	Parental Behaviour	Associated Outcome in Children
Authoritative	Warm, sensitive to child's needs, nurturing; makes reasonable demands and encourages appropriate autonomy	High self-esteem, cooperativeness, self-control, social maturity
Authoritarian	Cold, rejecting; makes coercive demands; frequently critical of child	Low self-esteem, anxious, unhappy, often angry and aggressive
Permissive	Warm, accepting, but overindulgent and inattentive	Impulsive, disobedient, overly dependent on adults, low initiative
Uninvolved	Emotionally detached and depressed; little time or energy for child rearing	Anxious, poor communication skills, anti-social behaviour

Another important question researchers have examined is how children's behaviours affect parenting styles, a transaction known as **reciprocal socialization**. Highly boisterous children are, for example, more likely to evoke authoritarian control behaviours in their parents (Givertz, 2015; Chan, 2010). Most of today's research on reciprocal socialization emphasizes the transaction between the parent and the child and holds that a *good fit* between a parent and child's behavioural styles is more important than some objectively right or wrong style (Newland & Crnic, 2016; Guyer et al., 2015). See Psychology Around Us 4.1 on the important role of fathers in parenting.

reciprocal socialization the transactional relationship between parent and child.

At the beginning of this section, we noted that the *Early Years Study 3: Making Decisions and Taking Action* (2011) report emphasized the importance of early experience. We now know that sustained early exposure to serious ongoing stress can disrupt the wiring of the brain, leading to changes in brain anatomy and altered gene expression. For illustration of the specific effects of early deprivation, let's return to our earlier discussion of Romanian orphans. There is a large body of data identifying the detrimental and injurious effects of early deprivation in this group of children. Specifically, data from diverse research laboratories indicates that as a group, children reared in Romanian institutions received inadequate stimulation to scaffold normal brain development (Nelson et al., 2012). As a result, these children experienced significantly reduced brain matter (Sheridan et al., 2012), significantly impaired head growth (Rutter et al., 2012), and the risk for socio-emotional and behavioural problems due to the role of critical periods (Julian, 2013). It is important to note that sustained early exposure to any type of extreme stress places a child at risk. Infants and children do not need to be institutionalized to experience changes in brain anatomy and gene expression in the brain and the increased risks over the lifetime

accompanying these changes, including increased risk for behavioural issues, mental health problems, and addictions (AFWI, 2017).

4.1 Psychology Around Us

Involved Fathers Contribute to the Well-Being of Their Children

Although most of the early research on parenting and attachment focused on mothers, we know that fathers are also important to children. Jessica Ball at the University of Victoria (Ball & Daly, 2012) reviewed Canadian and other relevant international research regarding fathers' contributions to children's well-being. The Public Health Agency of Canada included Ball's data in a general initiative looking at father involvement for healthy child outcomes (PHAC, 2011). The following findings indicate that fathers today play a direct and active role in their children's development:

> Fathers play a direct role in ensuring that their children have access to quality early childhood education, schooling, and supportive media.
>
> Fathers' ability to generate income for their families provides stability in housing, nutrition, and leisure activities, among other areas, which in turn reduces the risk of negative health outcomes associated with poor nutrition, obesity, and injuries.
>
> Youth who are close to their fathers are less likely to engage in substance use.
>
> When fathers are more actively involved in their children's school, the children do better academically.
>
> Children who have involved fathers are better able to tolerate stress and frustration, are better able to problem-solve, and have better relationships.

So, given that father involvement is so positive, shouldn't we find ways to encourage more fathers to play a more active role in their children's lives? That is precisely what members of the Fathers' Involvement Research Alliance under the guidance of Kerry Daly from the University of Guelph are trying to do (Daly, Ashbourne, & Brown, 2013). This group consists of researchers, community agencies, and fathers, and is committed to exploring and enhancing fatherhood among seven Canadian populations: Indigenous fathers, new fathers, young fathers, immigrant and refugee fathers, gay fathers, divorced fathers, and fathers of children with special needs. In Alberta, Karen Benzies at the University of Calgary, along with colleagues in Calgary and the University Alberta (Benzies et al., 2013, 2016), have shown that a simple program (two home visits with the father and infant), designed to encourage first-time fathers to become more actively involved in their new child's development, successfully increased father commitment and involvement.

Shawn Duthie can personally attest to the power of parenting and of the importance of having a father. He knows first-hand the trauma of growing up without parents. Neglected, abused, and lied to, he lived in the foster care system from the age of 5 years old. He is now an Indigenous father to Indigenous foster children and his adoptees range in age from 4 to 33 years. He says that his greatest wish is to prevent even one child from experiencing the childhood he had (Brash-Nyberg, 2020).

Source: jose aljovin/Unsplash.com

Fatherhood Shawn Duthie was raised in the foster system and says he therefore personally understands the importance of knowing that you matter to your family.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

7. What is the role of myelination in the development of the brain?

8. What is the Strange Situation?

9. What are the major parenting styles, and what are the primary child outcomes associated with each style?

10. In what areas of the brain is myelination concentrated during childhood, and how does myelination of these areas affect the child's cognitive functioning?

11. What are the crucial differences between Piaget's view of cognitive development and Vygotsky's view of cognitive development?

12. How are the ideas of scaffolding and zone of proximal development reflected in contemporary educational practices?

What Do You Think? • How do you think the various attachment styles correlate with Baumrind's parenting styles? Do you think there is one optimal form of parenting? Do

you think that men and women reason differently about morality? If the outcome is the same in our moral choices, does the reasoning we used to achieve that outcome matter?

Adolescence

LEARNING OBJECTIVE 5

Summarize the major physical, cognitive, and emotional changes that take place during adolescence.

With the possible exception of the first couple years of life, the rapid changes associated with adolescence rivals that of any other developmental passage. Most crucially, puberty begins. In the cognitive sphere, adolescents display features of both children and adults, and they begin to learn how to function independently. In this section, we will describe the key biological, cognitive, and social transitions that characterize this dramatic period.

Physical Development

Puberty refers to the physical development of primary and secondary sex characteristics (Bell, 2016). **Primary sex characteristics** are the body structures that have to do specifically with the reproductive system, including growth of the testes and the ovaries. **Secondary sex characteristics** refer to non-reproductive body events that differ according to gender, such as the deepening of the male voice or the increase in female breast size (see **Figure 4.12**).

puberty development of full sexual maturity during adolescence.

primary sex characteristics changes in body structure that occur during puberty that have to do specifically with the reproductive system, including the growth of the testes and the ovaries.

secondary sex characteristics changes that occur during puberty and that differ according to gender, but aren't directly related to sex.

The onset and course of puberty is influenced largely by the *pituitary gland*, which coordinates the activities of the rest of the endocrine system (Livadas & Chrousos, 2016). As you saw in Chapter 3, the endocrine system includes the *adrenal glands*, *testes*, and *ovaries*. During adolescence, events throughout this system stimulate the growth of body hair and muscle tissue and trigger the onset of the female menstrual cycle, among other changes. One of the most important changes is a *growth spurt* triggered by the thyroid gland that, as we observed earlier, actually begins for girls in middle childhood and for boys during early adolescence (Drummond, 2011) (see **Figure 4.13**). The growth spurt occurs about two years before the primary sex characteristics develop and is not only a harbinger of those later changes, but also helps prepare the body for them (Stafford, 2016).

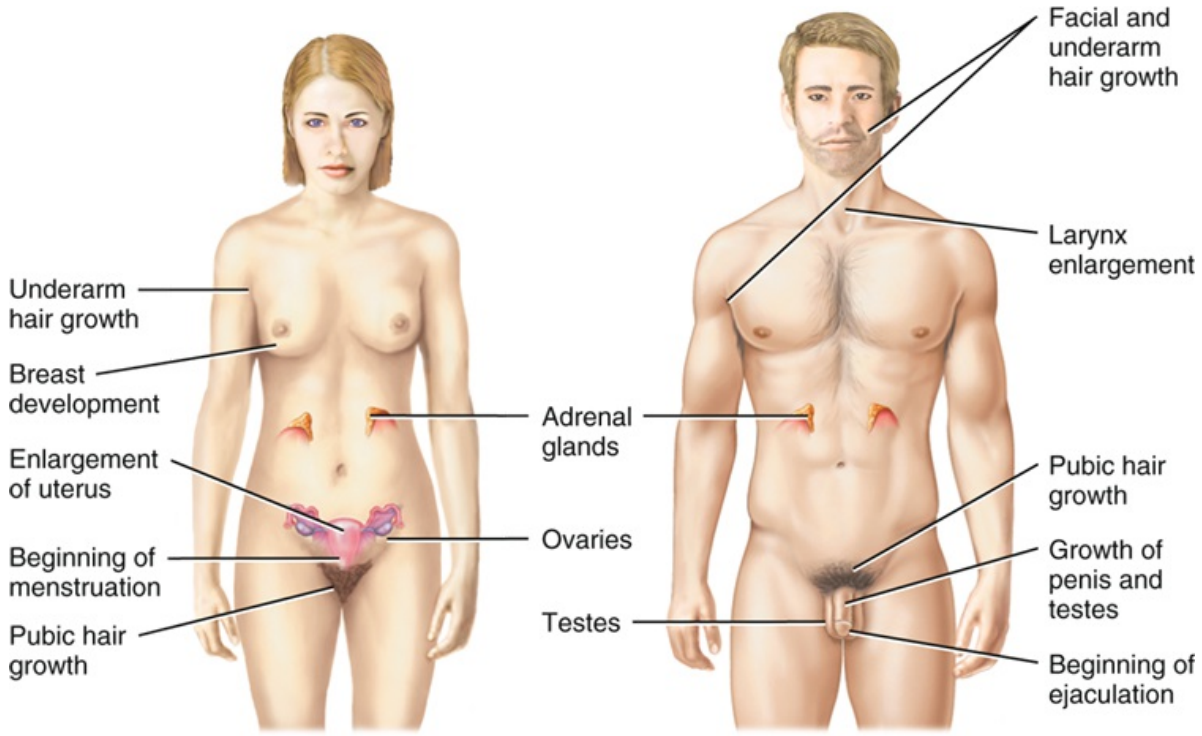


FIGURE 4.12 Primary and secondary sex characteristics The complex changes in puberty primarily result when hormones are released from the pituitary gland, adrenal gland, and ovaries and testes.

The changes of puberty stabilize after a couple years. In the meantime, however, many of those changes can be very disruptive to adolescents (Drummond, 2011). For both boys and girls, variations from age norms for puberty can be upsetting; girls who mature early and boys who mature late report more problems making the transitions through adolescence than those who enter puberty "on time" (Rudolph, 2014; Blakemore, Burnett, & Dahl, 2010).

The brain also goes through significant changes during adolescence (Foulkes & Blakemore, 2018; Dumontheil, 2016). Myelination continues to increase and synaptic connections continue to decrease as a result of synaptic pruning (Giedd & Denker, 2015; Selemon, 2013; Spear, 2013). Many of these brain changes appear to be localized; they now focus on the *prefrontal cortex*, the brain area that helps coordinate brain functions and is instrumental in making sound judgments (see Your Brain and Behaviour 4.1). Development of the prefrontal cortex is incomplete until individuals reach their mid-twenties (Goddings et al., 2019; Eslinger & Long, 2016; Zhou et al., 2016). Many psychologists point to immaturity in the prefrontal cortex as one reason teenagers often display poor judgment in their daily functioning (Giedd, 2016; Leshem, 2016). Immature brain areas, however, are not the whole story. For example, adolescents are also strongly affected by their peers (Duell, Icenogle, & Steinberg, 2016; Guyer, Silk, & Nelson, 2016).

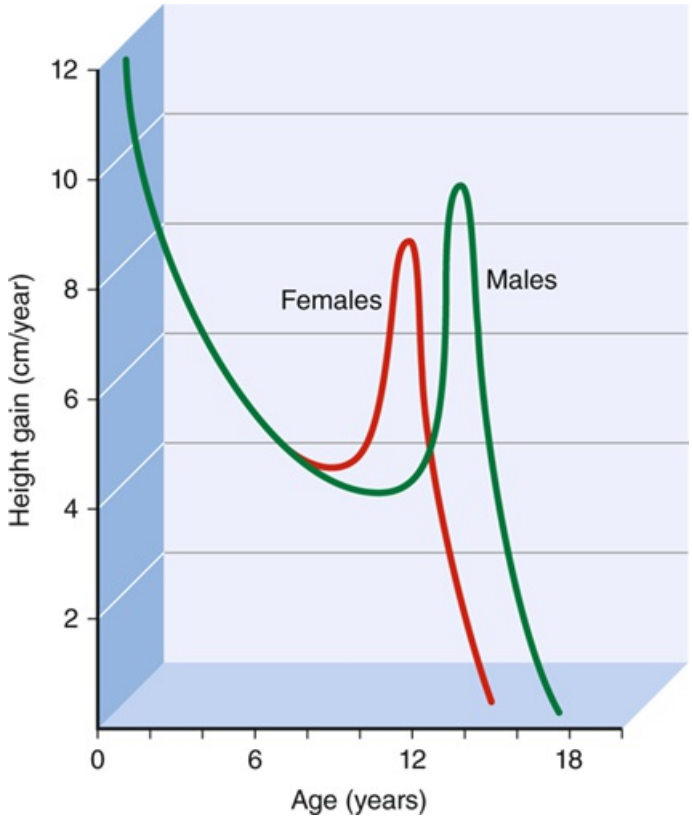


FIGURE 4.13 Adolescent growth spurt The growth spurt of girls occurs, on average, two years before that of boys. Thus, between the ages of 10 and 14 years, the average girl is taller than most boys. Adapted by permission from BMJ Publishing Group Limited. Archives of Disease in Childhood, J.M. Tanner, R.N. Whitehouse, and M. Takaislu, vol. 41, pp. 451–471, 1966.

Cognitive Development

As we mentioned above, adolescent thinking has features of both child cognition and adult cognition. Teenagers show increased capacity for reasoning about abstract things, but also have deficits in their abilities to see outside of the moment or to take others' points of view. These strengths and limitations both come into play in their social and emotional growth as adolescents attempt to define themselves as persons (Hatano, Sugimura, & Klimstra, 2016; Umaña-Taylor et al., 2014). (See photo.) The shift into the formal operational stage opens the door to higher-level moral thinking (Lerner & Jovanovic, 2016; Malti & Ongley, 2014; Sommer et al., 2014; Kohlberg, 1963). Adolescents may recognize, for example, that rules serve a societal purpose, not just a personal one. With this growth in cognitive and moral thought, adolescents begin looking at the validity of rules very closely (Kilford, Garrett, & Blakemore, 2016). They realize, for example, that an 11:00 p.m. curfew is, in many respects, an arbitrary rule that can be challenged and perhaps changed. Similarly, they become aware that adults often behave in ways that contradict what they say. According to pioneering developmental psychologist David Elkind, these realizations may cause adolescents to feel angry and upset and may produce a desire to rebel (Tyler, 2020; Scott & Saginak, 2016a, 2016b; Elkind, 1978, 2007). This is a reason why conflict between parents

(and other adults) increases in adolescence (see photo).

monkeybusinessimages/Getty Images

Adolescent behaviour Immature brain areas and peer pressure contribute to adolescents' poor judgment in their daily functioning.

Elkind notes that adolescents' mastery of formal operational thinking enables them not only to tune in to the flaws of other people, but also to recognize their own flaws. They become very sensitive to what other people may be thinking about them. Correspondingly, they display a psychological phenomenon called *adolescent egocentrism*, the mistaken belief that, like they themselves are doing, everyone else is also focusing largely on them and their behaviour (Rai, Mitchell, Kader, & Makenzie, 2016).

One feature of adolescent egocentrism is the *personal fable*, the adolescent belief that they are unique and invincible. Over the course of searching for a sense of identity and spending time deeply focused on their own thoughts and feelings, adolescents may become convinced that they are special—the only person to have particular thoughts and feelings (e.g., if an adolescent endured a particularly embarrassing event, he would likely feel that no one could have ever experienced such embarrassment). This sense of being special extends to feeling invincible; that is, "Bad things happen to other people, other people get pregnant, get caught drinking and driving, or become addicted to cocaine; but these bad things will not happen to *me*." Couple this belief with the adolescent brain (immature frontal lobe for inhibiting behaviour and functional reward and pleasure-seeking systems) and the adolescent is often unable to resist the lure of the rewards of risky behaviours (Hanna, 2017; Lin, 2016; March, 2016). Another feature of adolescent egocentrism is the *imaginary audience*. Adolescents feel that everyone is scrutinizing them, as if they are on stage, a notion that leads to strong feelings of inhibition and self-consciousness (Cingel & Krcmar, 2014; Somerville, 2013).

doble-d/Getty Images

Not the boss of me! Studies suggest that teens who argue with their mothers may be better at withstanding peer pressure (Allen et al., 2012).

Moral Development

Moral development focuses on cognitive *moral* understanding, how children and adolescents acquire an appreciation of right and wrong that is necessary if they are to function autonomously and safely in a complex society (see Indigenous Experiences 4.2).

Kohlberg's Theory of Moral Development

Lawrence Kohlberg was particularly interested in Piaget's ideas on moral development. Piaget believed that, as with general logical reasoning, children learn how to reason morally by applying their emerging logical thinking to the issue of different perspectives and social wants and interactions—seen in children's games and their understanding and application of game rules. He proposed that children's morality is based initially on obeying adults. As they get older, the basis of their moral reasoning shifts toward cooperation with peers (Piaget, 1965).

4.2 Indigenous Experiences

"Killing the Indian in the Child"

The goal of residential schooling is believed by many to have been to impose cultural assimilation onto the Indigenous peoples of Canada. In a keynote address, then-Chief Justice of the Supreme Court of Canada, Beverley McLachlin, referred to residential schooling as Canada's "attempt to commit 'cultural genocide' against Indigenous people" (Stromquist & Knickerbocker, 2015, p. 30).

Indeed, the stated intention for the schools was to use them to break the bonds between children and their parents, communities, and cultures. In 1920, Duncan Campbell Scott, then Deputy of Indian Affairs, the superintendent of the residential

schooling system, said "I want to get rid of the Indian problem … Our objective is to continue until there is not a single Indian in Canada that has not been absorbed into the body politic" (Stromquist & Knickerbocker, 2015, p. 8). That same year, Scott amended the Indian Act, making it a legal requirement for all Indigenous children to attend residential schools. The quoted aim of "killing the Indian in the child" is often attributed to Scott. However, a version of this statement, "Kill the Indian in him, and save the man," was instead made by American Brigadier General Henry Pratt, the founder of the Carlisle Indian Industrial School at Carlisle, Pennsylvania, in 1879 (Fraust et al., 2004). Many residential schools were modelled on this school.

In the Canadian residential schools, children were forbidden, often punished, for speaking their Indigenous languages and were frequently taught that their cultures were inferior and that they, and their families, were without value (Truth and Reconciliation Commission of Canada, 2015). Mercy Thomas said, "We will go to our graves carrying this hurt. There is not enough money in the world to buy away the hurt, shame, humiliation, loss of identity, and near annihilation of Aboriginal culture. It was nearly genocide" (Stromquist & Knickerbocker, 2015, p. 21). In her Nisga'a language, Thomas's birth name meant "pearl skipping on clear water" but on her first day of school at the Crosby Girls School in Port Simpson, she was told that she would now be known as "Mercy." She said that the children frequently heard, "You good-for-nothing, dirty, lazy Indian! If you hear that every day, you start to believe it. Some of us fought against it and we left school stronger. Others fell by the wayside and died" (p. 20).

Children were not only renamed but many were numbered as well. These numbers were used to identify not just them but their clothes, lockers, and beds. The children frequently lined up by number and were referred to by number instead of by name (Truth and Reconciliation Commission of Canada, 2012). A survivor who attended a school in Quebec said this numbering robbed her of her identity: "I was number one hundred and sixteen. I was trying to find myself; I was lost" (Truth and Reconciliation Commission, 2012, p. 23).

Mona Makela/Shutterstock.com

Shamed and hurt **Identity issues afflicted both survivors of the residential school system and subsequent generations, exerting a lasting intergenerational effect.**

Another Survivor, Marjorie Flowers, reported, "I lost a lot. I lost a lot of my culture and parenting and role models. I did. I lost a lot. I gained my education, but I lost a lot of me in the process. I almost didn't know who I was. I wanted to be someone else and it took a long time to come back and find my roots" (Igloliorte, 2010, p. 69).

Critical Thinking Questions

How would identity development be affected by the experiences of the Indigenous children and adolescents who attended Canadian residential schools?

Why do you think Indigenous langauges were forbidden in residential schools?

Why do you think Indigenous children were renamed or given numbers instead of being allowed to use their birth names?

Kohlberg expanded upon Piaget's ideas and developed a method to evaluate the moral reasoning processes of children. He presented children, adolescents, and young adults with

stories that included moral dilemmas, such as the story of Heinz in **Figure 4.14**, and asked them to say what the main characters in the stories should do and why they believe that to be the right choice. It is important to note that these stories are a product of the time they were developed (in the 1960s) and so rely on traditional ideas about gender and relationships. However, even though the stories are dated the conclusions drawn about moral development continue to be useful.

Heinz and the Drug

In Europe, a woman was near death from a special kind of cancer. There was one drug that the doctors thought might save her. It was a form of radium that a druggist in the same town had recently discovered. The drug was expensive to make, but the druggist was charging ten times what the drug cost him to make. He paid $400 for the radium and charged $4,000 for a small dose of the drug. The sick woman's husband, Heinz, went to everyone he knew to borrow the money and tried every legal means, but he could only get together about $2,000, which is half of what it cost. He told the druggist that his wife was dying, and asked him to sell it cheaper or let him pay later. But the druggist said, "No, I discovered the drug and I'm going to make money from it." So, having tried every legal means, Heinz gets desperate and considers breaking into the man's store to steal the drug.

Question: Should Heinz steal the drug? Why or why not?

FIGURE 4.14 Kohlberg's moral dilemma story Paragraph excerpted from Scott Lilienfeld, Steven Lynn, Laura Namy, and Nancy Wolf, *Psychology: From Inquiry to Understanding* (2008; Boston: Pearson: Allyn & Bacon.)

On the basis of his studies, Kohlberg developed a stage theory of moral development, depicted in **Table 4.7** (Kohlberg, 1963, 1994, 2008). This theory is based on *moral reasoning*, how children come to their decisions about what is right and wrong, rather than on the particular decisions that they make. Kohlberg argued that in the earliest stages, individuals' moral decisions are based on external rewards and punishments. Then individuals move to a stage where they internalize the standards of others. Finally, individuals develop an internalized, personal moral code.

Although Kohlberg believed that moral reasoning often is correlated with other areas of development, such as cognition or intelligence, he held that it develops independently. Larry Walker (Hardy et al., 2014; Walker, 2013, 1980), at the University of British Columbia, demonstrated that children's cognitive development makes it possible for them to take up more mature understandings of the nature of others' perspectives, which in turn make it possible for them to develop higher (Kohlberian) stages of moral reasoning. To reach the highest stages of moral reasoning, Kohlberg believed, individuals must be exposed to complex social situations (Kohlberg, 1981).

Like Piaget's theory of general cognitive development, Kohlberg's (1981) theory suggests that each stage of moral development is not just a shift in complexity, but instead represents a new framework, or way of thinking, for making moral decisions. Each such stage forms a foundation for the next stage, and children must travel through the stages of moral development in sequence. A child may be delayed or perhaps even fail to reach some

of the higher stages, but he must go through each earlier stage to reach the next one.

TABLE 4.7

Kohlberg's Stage Theory of Moral Development

Stage	Reason to Steal Drug	Reason Not to Steal Drug
Preconventional: Morality centres on what you can get away with	If he saves his wife she will continue to take care of his children.	He will be caught and go to jail.
Conventional: Morality centres on avoiding others' disapproval and obeying society's rules	If he doesn't steal the drug people will think he is a bad husband.	If he steals, people will think he is a criminal; it's against the law.
Postconventional: Morality is determined by abstract ethical principles.	The right to life is universal and takes precedence over the right to property.	Laws are necessary to maintain order in society; individuals cannot break laws just because they disagree with them or we will lose all social order.

Finally, Kohlberg believed that the process of moral development is universal and happens the same way in every culture. Kohlberg's original research included boys only, but he later studied girls and conducted moral dilemma interviews in villages in Mexico, Taiwan, and Turkey (Nisan & Kohlberg, 1982).

Gilligan's Theory of Moral Development

One of Kohlberg's collaborators, Carol Gilligan (1993), eventually questioned some of his findings and ideas, partly because his studies initially focused on boys alone, and also because his later studies seemed to suggest that girls were morally less developed than boys. Kohlberg believed that girls did not have as many complex social opportunities as boys and, as a result, were excessively concerned with the standards of others and therefore often failed to achieve higher stages of moral reasoning.

Gilligan (1993) interpreted the boy–girl findings differently. She argued that the moral reasoning used by girls is indeed different from that of boys, but not inferior. She argued that boys tend to base their decisions about moral dilemmas on abstract moral values, such as justice and fairness. Many girls look at the situations differently. Instead of the abstract values involved, they focus more on care—on the value of relationships between the principal players. A boy's answer to the Heinz dilemma might centre on the importance of property value for the druggist, for example, while a girl's answer might stress that Heinz will not be able to help his wife if he is jailed for stealing the drug (Gilligan, 1993). Gilligan argued that the reasoning of boys and girls is equally sophisticated, but the moral orientation with which they approach dilemmas may differ. Gilligan found that both males and females were capable of both justice- and care-based moral thinking, and which one they used varied depending on the circumstances in which they were asked.

Other studies have not always supported Gilligan's theory that women and men differ in their moral orientation, nor have they always supported Kohlberg's notions of moral superiority among males (Turiel, 2016; Hardy et al., 2014; Pierce, 2014). However, Gilligan's ideas have had a broad influence on psychology, anthropology, and other social sciences. As a result of her arguments, many researchers now include more females in their studies. In addition, most of today's researchers think of differences among participants as individual variations rather than positive or negative characteristics (Jensen, 2011).

Finally, a number of moral development researchers, including Dennis Krebs at Simon Fraser University, have investigated whether the moral attitudes of people is reflective of their actual decision making (Denton & Krebs, 2017; Krebs, 2011). As we will see in our discussion of attitudes in Chapter 13, people do not always actually do what they say they will do in moral situations (an experience you've perhaps had once or twice in your own life). See Psychology Around Us 4.2 to read about the moral situation of bullying in adolescence and over the rest of the lifespan. Because the vast majority of research into moral reasoning has relied on Kohlberg's moral dilemma interviews, many researchers argue that we may be able to say a fair amount about people's moral *philosophies* but little about their moral *behaviours*. However, Krebs also argues that because morality serves an evolutionarily adaptive function by allowing individuals to foster their own self-interest while befitting others, moral thought is often reflected in behaviour (Denton & Krebs, 2017; Krebs, 2011).

Social and Emotional Development

Although identity formation is a lifelong task, adolescents spend a lot of time trying to figure out who they are and how they fit into the world. The adolescent has the cognitive ability to integrate previous and current identities into a coherent whole. Erik Erikson viewed identity development as the task of adolescence (Illeris, 2017; Erikson, 1959, 1984, 1985).

4.2 Psychology Around Us

Bullying in Schools and Workplaces

According to the Canadian Public Health Association, *bullying* is the intentional use of power to harm, intimidate, or coerce a vulnerable person and may employ physical, psychological, social, verbal, and/or technological tactics (Lemstra et al., 2012). Bullying affects children, adolescents, and adults.

One survey asked children aged 8 to 15 years what issues in school troubled them most, and they pointed to teasing and bullying as "big problems" that ranked higher than racial discrimination, AIDS, and/or peer pressures (Panayiotou, Fanti, & Lazarou, 2015). Over one-quarter of students reported being bullied frequently, and more than 70 percent reported having been victimized at least once, leading in many cases to feelings of humiliation or anxiety (Juvonen & Graham, 2014). In addition, our online world has broadened the ways in which children and adolescents can be bullied, and today cyberbullying—bullying by email, text messaging, or social media—is increasing (Iranzo, Buelga, Cava, & Ortega-Barón, 2019; Chatzakou et al., 2019). Tanya Beran and

her colleagues at the University of Calgary (2015) report results from a national study indicating that one in seven Canadian children is a victim of cyberbullying and one in 13 is a perpetrator of cyberbullying. Moreover, their results indicate that both victims and perpetrators of cyberbullying are more likely than other children to be involved in other forms of bullying.

In response to these alarming trends, many schools—elementary through high school—have programs that teach students how to deal effectively with bullies. They aim to change the thinking of bullies, train teachers, conduct parent discussion groups, and apply classroom prevention measures (Bradshaw, 2015; Lee et al., 2015; Evans, Fraser, & Cotter, 2014). Additionally, public health campaigns have been developed in an effort to educate the public about anti-bullying programs. For information about bullying, see the following organizations and programs: Bullying Canada, www.bullyingcanada.ca/; Canadian Safe School Network, https://cssn. the Government of Canada (Public Safety Canada) Bullying Prevention in Schools Program, www.publicsafety.gc.ca/cnt/rsrcs/pblctns/bllng-prvntn-schls/index-en.aspx; and the Red Cross: Bullying and Harassment Prevention program, https://www.redcross.ca/how-we-help/violence-bullying-and-abuse-prevention.

Bullying is not just aimed at children and adolescents. Workplace bullying involves an aggressive assertion of power in the form of harmful, targeted, repeated behaviours intended to injure another person physically and/or emotionally in a work environment. Bullying can have significant effects on both physical and mental health. Brock University's Usman Raja and his colleague, Saima Naseer, from the International Islamic University (2018), published results suggesting that workplace bullying erodes resources such as perceived organizational support and that this loss of resources leads to burnout and strain. Distress and anxiety are especially pronounced when the negative behaviours are initiated by someone in authority over the victim. Existing laws protect workers against bullying, but bullying is not always easy to recognize or to prove.

It is important that we take steps to stop bullying at every stage of the lifespan. If you have been bullied, reach out for help. There are ways to combat bullies without confronting them directly.

tigristiara/123RF

Workplace bullying **Bullying affects adults in the workplace much as it affects children and adolescents in schools and over social media.**

As Table 4.8 shows, and as discussed previously, Erikson believed that each stage of development is associated with a potentially positive outcome versus a potentially negative outcome.

The key developmental task faced by adolescents is to resolve the conflict between *identity* and *role confusion*. During adolescence, teenagers start making decisions that affect their future roles, such as where they want to go to college or university or what they want to do with their lives, as well as decisions about abstract aspects of their identities, such as political or religious beliefs (Côté & Levine, 2014). The Psychology@Work video on Career Development looks more closely at some of the ways that this developmental task has become more difficult in recent years.

Video **PSYCHOLOGY@WORK**

Career Development **This video looks at I/O psychology research into the ways in which pathways into careers have become less distinct in recent years making it difficult for young people to target career entry goals. Rather than counting on having several jobs within a single career, emerging adults are told that they should expect to have several distinct careers over their work lives. This means that career planning today is more about figuring out yourself rather than finding a job or career path to aim toward.**

According to Erikson, if we do not reach a successful resolution of the conflict confronted at a particular stage, we may find it harder to meet the challenges of subsequent stages. Teenagers who do not effectively resolve the conflicts of their earlier psychosocial stages may enter adolescence with heightened feelings of mistrust and shame (see Psychology Around Us 4.2). These lingering feelings may render the teens particularly confused about which roles and beliefs truly reflect their own values and which ones reflect autocratic peer

and family influences (Arnett, 2015). Peer relationships are extremely important to all teenagers, and Erikson believed that vulnerable teens are particularly likely to be confused about where their own beliefs start and the wishes of others end. The influence of peers is of particular concern in the digital age as adolescents are bombarded with multiple influences and conflicting views on desirability of behaviours and values (Davis & Weinstein, 2016).

TABLE 4.8

Erikson's Stages of Psychosocial Development

Stage 1 Trust versus mistrust (birth–age 1) Infants develop a basic trust in others. If their needs are not met by their caregivers, mistrust develops.
Stage 2 Autonomy versus shame and doubt (ages 1–3) Children exercise their new motor and mental skills. If caregivers are encouraging, children develop a sense of autonomy versus shame and doubt.
Stage 3 Initiative versus guilt (ages 3–6) Children enjoy initiating activities and mastering new tasks. Supportive caregivers promote feelings of power and self-confidence versus guilt.
Stage 4 Industry versus inferiority (ages 6–12) Children learn productive skills and develop the capacity to work with others; if not, they feel inferior.
Stage 5 Identity versus role confusion (ages 12–20) Adolescents seek to develop a satisfying identity and a sense of their role in society. Failure may lead to a lack of stable identity and confusion about their adult roles.
Stage 6 Intimacy versus isolation (ages 20–30) Young adults work to establish intimate relationships with others; if they cannot, they face isolation.
Stage 7 Generativity versus self-absorption (ages 30–65) Middle-aged adults seek ways to influence the welfare of the next generation. If they fail, they may become self-absorbed.
Stage 8 Integrity versus despair (ages 65+) Older people reflect on the lives they have lived. If they do not feel a sense of accomplishment and satisfaction with their lives, they live in fear of death.

Other issues can make it difficult to establish a strong sense of personal identity. For members of visible minority groups, such as Canada's Indigenous youth, identity development is made more difficult both by a sense of difficulty in fitting into mainstream cultural identity options and opportunities, as well as difficulty in finding positive, healthy images of personal and cultural history and ideals to lean on for support (Darwich, McClure, & Hymel, 2016; Burack et al., 2014).

Darryl Dyck/The Canadian Press

Canadian Indigenous youth An Indigenous youth participates in the Squamish Nation Youth Pow Wow in North Vancouver, B.C. About 140 dancers gathered in the 27th annual event to compete for prizes and showcase their culture.

One large-scale study conducted in British Columbia shows the central roles of culture and community in positive adolescent developmental outcomes. Michael Chandler, Professor Emeritus at the University of British Columbia until his death in 2019, and Chris Lalonde at the University of Victoria (Chandler & Lalonde, 2019; Lalonde, Cila, & Yampolsky, 2016; Chandler, 2014, 2013) examined rates of youth suicide in many of the Indigenous youth across the province of British Columbia (Chandler, Lalonde, Sokol, & Hallett, 2003). Rather than focusing on individual suicides, they examined instead what they called cultural continuity factors, markers of personal, cultural, and community efforts to take charge of and advance culture and heritage. Specifically, they identified whether individual bands had taken or were taking steps toward self-government, including control of the education of their children, control of their health services, and control of police and fire services; whether the band had initiated land claims; and finally whether there was a structure on their land specifically dedicated to the recognition and promotion of their culture and heritage. **Figure 4.15** indicates that the more engaged in taking or re-taking cultural control a First Nations community is and the more they assert their cultural authority over aspects of self-determination, the lower their rate of adolescent suicide—approaching zero when all six markers of community control of culture and heritage are present. When the cultural or social side of the individual/community interaction that defines identity formation is strong, youth can develop strong identities and can see clear, culturally- and community-defined and supported pathways for them to walk as they move forward into adulthood (Brussoni et al., 2016). (See photo.)

Jessica Ball of the University of Victoria states that the culture within the individual (2012a; 2012b) is an important determinant of healthy development. Other researchers, too, argue that successful identity development is an integral part of a successful transition to adulthood, and one that for Indigenous youth can involve community as well as individual development (Burack et al., 2014).

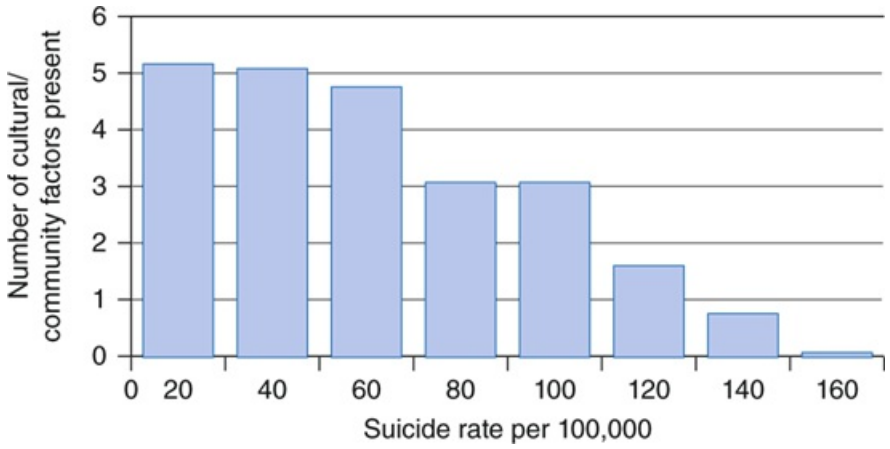


FIGURE 4.15 Indigenous youth suicide rate by number of cultural factors present in the community **This figure shows that the more a Indigenous band community does to take active control of their culture, the lower the rate of youth suicide in that community. *Source:* Based on Chandler, M. J. & Lalonde, C. E. (2008). Cultural continuity as a moderator of suicide risk among Canada's First Nations. In L. J. Kirmayer & G. G. Valaskakis (Eds), *Healing traditions: The mental health of Aboriginal peoples in Canada*.**

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

13. If a child arrives at puberty significantly earlier or later than her peer group, how might that affect her adjustment?

14. Define the formal operational stage.

15. Describe what Erikson believed was the major dilemma and risk for adolescence.

16. How do contemporary theories of moral reasoning differ from Piaget, Kohlberg, and Gilligan?

17. What are some differences between first-borns and later-borns?

What Do You Think? • How might Erikson explain extremely altruistic or aggressive adolescents?

Adulthood

LEARNING OBJECTIVE 6

Describe the key physical, social, and emotional changes that take place throughout adulthood.

Traditionally, developmental psychology viewed adulthood as an outcome rather than a period of time worthy of study. As we will see, however, adulthood is in fact a time of continuing change—and by change, we do not necessarily mean decline.

The journeys through each stage of adulthood correspond to many of the rites of passage associated with adulthood, including marriage, parenting, retirement, and death—events that we will be discussing further throughout the book. It is worth noting that, in many societies, the timing and form of such milestones of adulthood are now more variable than they were in earlier days. In the past, for example, the length of time a couple would spend married before having their first child was relatively short; that time has extended greatly in recent decades. Moreover, the number of couples who choose to remain childless has doubled since 1960 (Laplante, Morency, & Street, 2015; Lee & Zvonkovic, 2014; Rubino, 2011). It has also become more acceptable in some societies for people who are not married to raise children (Jennings et al., 2014), with almost one-quarter of Canadian children living in single parent homes at present (Bohnert, Milan, & Lathe, 2014).

Similarly, the average human lifespan continues to increase, lengthening the time that older adults remain part of the workforce, as well as part of the retired population, before dying (McDaniel, Wong, & Watt, 2015). Such cultural shifts have opened new areas of study for psychologists, who are seeking to understand how these shifts may affect adult development.

Â© Hiya Images/Corbis/Getty Images

Stages This daughter and mother are experiencing different types of changes as they transition through life stages.

Although the foundations for development are laid down in childhood and adolescence, we spend most of the lifespan in adulthood. Adulthood moves us through a number of stages and transitions and changes (see photo). Let's take a look at some of them.

Physical and Cognitive Development

With the end of adolescence comes full maturity. Nevertheless, the body continues to go

through changes during adulthood. And, so does the brain.

What Happens in the Body During Adulthood?

Generally, physical attributes, such as strength, reaction time, and overall body function, are at their peak during our 20s (Kail & Cavanaugh, 2015). As we move into our 30s, the body begins to decline slowly. Our metabolism slows, for example, and it is harder to keep fit.

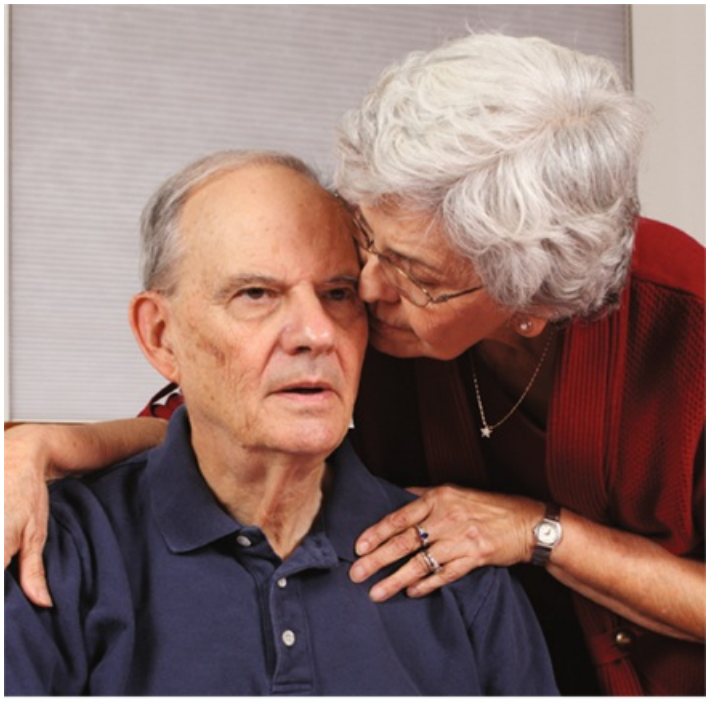
During our 30s and 40s, we begin to show the first significant signs of aging. Due to loss of collagen and fat, skin begins to lose some of its tautness and hair begins to grey and thin. Declines in vision and hearing are experienced after the age of 40 (Drummond, 2011). Individuals become more farsighted, finding it hard to read or see small objects close to them, and have difficulty seeing in the dark or recovering from sudden glares of light (Martínez-Roda et al., 2016). At this same time, individuals, especially men, become less sensitive to high-frequency sounds (Lin et al., 2013).

Women go through a major change called **menopause**, typically in their 50s (Nosek et al., 2010). *Menopause* involves a series of changes in hormonal function that eventually lead to the end of the menstrual cycle and reproductive capabilities. The early phase of menopause is often associated with a variety of physical experiences, such as hot flashes, headaches, and sudden shifts in mood due to sudden changes in levels of hormones.

> **menopause** series of changes in hormonal function occurring in women during their 50s, which lead to the end of the menstrual cycle and reproductive capabilities.

As adults move into late adulthood during their 60s and 70s, they may become a bit shorter and thinner due to changes in skeletal structure and metabolism (Cline et al., 2014; Drummond, 2011). The immune system also begins to decline in function, leaving them at higher risk for illness. Vision and hearing continue to decline, joined by the sense of taste. The pupils shrink, so that less light reaches the retina, making it harder to see in low light (Martínez-Roda et al., 2016).

The story is not as simple as a long, slow, inevitable decline, however. Environmental factors, such as exercise, stress, diet, and life experience, can have a dramatic influence on the course and impact of these changes (Drummond, 2011; Karimi et al., 2016). Although declines are common, many of the changes can be subtle and have minimal impact on how well older adults function in the world.



AvailableLight/Getty Images

Dementia **Dementia is a symptom of brain disease or injury and is associated with memory loss, impaired reasoning, and personality change.**

Cognitive Changes in Adulthood

Until recently, neuroscientists believed that our brains begin to shrink during adulthood, both in terms of volume and weight, and that much of this loss is attributable to the shrinkage and loss of active brain cells (Persson et al., 2016). Research over the past decade, however, has revealed that no significant loss of neurons occurs in adulthood, except in cases of brain pathology (Mills et al., 2016; Sowell & Tamnes, 2016). Neurons continue to form in certain parts of the brain throughout life, including adulthood (Leuner & Gould, 2010). In fact, these neurons may be the result of new learning, may play a role in further learning, or both (Akers et al., 2014; Leuner, Glasper, & Gould, 2010). Given the stability and even addition of neurons during adulthood, it is not surprising that most of our broad intellectual capabilities remain intact throughout our lives. We're able to solve problems and process information in our adult years about as quickly as we could in our 20s (Johnson, McGue, & Deary, 2014).

Source: LookatSciences/Medical Images.com

Downward slide **In this computer illustration, the green-glowing proteins at the end of the chromosomes are telomeres, tiny structures that help cells to reproduce. The structures appear to grow shorter and shorter with repeated use, leading eventually to reduced cell reproduction and poor self-repair by the body. Then, when the telomeres are gone, the cell stops duplicating.**

Once adults move into their 40s and 50s, recovering information from long-term memory begins to take a little longer, and it takes somewhat longer to learn new material. During their 60s and 70s, adult memories decline, as does adults' confidence in their ability to remember and to solve problems (Stephan et al., 2015; Ornstein & Light, 2010).

Some declines are more serious than others, however. In *dementia*, severe memory problems combine with losses in at least one other cognitive function, such as abstract thinking or language (Petersen et al., 2014; Travers, Martin-Khan, & Lie, 2010). The occurrence of dementia is strongly related to age. Around 1 to 2 percent of people 65 years of age have dementia, compared with some 50 percent of people over 85 (Kosteniuk et al., 2015; Gardner et al., 2014; Prince et al., 2013). We will discuss dementia in depth in Chapter 8 (see photo).

Why Do We Age?

Although scientists have offered many theories about why we age, no single explanation is widely accepted (Bengtson & Settersten, 2016). One important theory of aging, the **cellular clock theory**, suggests that aging is built into our cells. Tiny structures on the ends of DNA strands, called *telomeres*, aid in cell reproduction but grow shorter with age. Eventually they become too short, and cells can no longer reproduce (Roake & Artandi, 2016). As a result, the body is less able to repair itself (see illustration). The various changes of aging—slack skin and decreases in vision and memory, for example—are the direct result of those events (Fyhrquist & Saijonmaa, 2016).

cellular clock theory theory suggesting that we age because our cells have built-in limits on their ability to reproduce.

Two other theories of aging are more rooted in our experiences and the impact that life events can have on us. The *wear-and-tear* and *free-radical* theories suggest that years of use wear out our bodies. The **wear-and-tear theory** argues that the more mileage we put on our bodies through living (augmented by factors such as stress, poor diet, and exposure to environmental teratogens), the sooner we wear out (Palmer & Kirkland, 2016). The **free-radical theory** provides a chemistry-oriented explanation (Forman, 2016; Halliwell & Gutteridge, 2015). Free radicals are oxygen molecules that are negatively charged. A negative charge on a molecule can attract small particles of matter called *electrons* from other molecules. According to the free-radical theory of aging, free radicals become more prevalent in our system as we get older, increasingly destabilizing cell structures and doing progressively more damage to our bodies—resulting in the aging effects described above.

wear-and-tear theory theory suggesting we age because use of our body wears it out.

free-radical theory theory suggesting we age because special negatively-charged

oxygen molecules become more prevalent in our body as we get older, destabilizing cellular structures and causing the effects of aging.

Social and Emotional Development

Although the social and emotional changes that occur in adulthood are more gradual than those that characterize childhood, adults do in fact experience multiple transitions throughout the adult stage of the lifespan (Coleman & O'Hanlon, 2017; Kunzmann & Wrosch, 2015; Cummings, Greene, & Karraker, 2014). As you saw in **Table 4.8**, Erikson proposed that individuals confront important psychosocial conflicts as they move through early adulthood to old age.

Social and Emotional Features of Early and Middle Adulthood

According to Erikson (1959, 1984, 1985), during early adulthood (20 to 30 years of age), people form intimate relationships and sexual unions that call for self-sacrifice and compromise. In fact, Erikson believed that the primary goal of this period is to attain love. As well, the ethical convictions developed in adolescence and the sense of moral obligation formed in childhood contribute to ethical strength in young adulthood. These early experiences are important, he believed, because a sense of morality is required for the truly loving relationships of adulthood. Erikson further believed that people who are unable to successfully meet the challenges of young adulthood tend to become isolated and may actually avoid the contacts that create and sustain intimacy. Thus, he concluded that young adulthood is dominated by a conflict between *intimacy* and *isolation*.

Erikson proposed that during middle adulthood (30 to 65 years of age), people are inclined to turn their attention to younger people. Their focus is to help create, or at least contribute to, the next generation. Erikson used the term *generativity* to describe this focus. People in this stage care for younger people, whether through parenthood or by mentoring junior colleagues at work. These life experiences are enriching for those with this focus (see photo). Erikson believed that people who fail to develop such activities may experience stagnation and boredom. Middle adulthood, then, is dominated by a conflict between *generativity* and *stagnation*.

Goldmund/Getty Images

Erikson's stage of generativity **In middle age individuals turn their attention to younger generations, including in many cases to their children and their grandchildren.**

Several theorists have extended Erikson's work on early and middle adulthood. One particularly broad investigation of these life stages was conducted by psychologist Daniel Levinson (1977, 1984, 1986; Levinson & Levinson, 1996). According to Levinson's findings, the stage of *early adulthood* (which he defined as 22 to 40 years of age) is simultaneously characterized by high energy and abundance and by contradiction and stress. Individuals in this age range establish a niche in society, they may raise a family, and ultimately they reach a relatively "senior" position in the adult world.

For many, this period brings great satisfaction and creativity. But early adulthood can also be a period of enormous stress. The burden of becoming a parent, undertaking an occupation, incurring financial obligations, and making other critical decisions about marriage, family, work, and lifestyle often fills people with anxiety and tension.

Levinson described *middle adulthood* (30 to 65 years of age) as a stage in which biological functioning, although less than optimal, is still sufficient for an "energetic, personally satisfying and socially valuable life." During this stage, people usually become "senior members" in their particular world. They take responsibility for their own work, that of others, and the development of younger adults. This, too, can become a period of self-satisfaction and peace of mind. At the same time, growing biological problems, numerous responsibilities, and anticipation of upcoming old age may produce considerable stress and tension.

Although the stages of early and middle adulthood may themselves be sources of stress, Levinson believed that the periods of *transition* that people must pass through as they move from one stage to another can be even more pressure-filled. During such transitional periods, people confront particularly difficult career, marital, and family issues and reflect on and adjust their dreams.

The *early adult transition*, often called "emerging adulthood," bridges adolescence and early

adulthood. During this period, which lasts from approximately 17 to 22 years of age, people may go through a very unsettled time. They take steps toward individuation and modify their relationships with family, friends, and social institutions, but they may feel insecure in these efforts and, correspondingly, may experience anxiety and confusion. Indeed, in today's world, more and more individuals seem to be having difficulty completing this early adult transition (Bellingtier & Neupert, 2019; Schiller, Hammen, & Shahar, 2016).

Even more stressful for some people, according to Levinson, is *middle life transition*, a period lasting from ages 40 to 45 that bridges early and middle adulthood. During this period, individuals experience significant changes in the character of their lives. On the positive side, they may become more compassionate, reflective, and judicious; less conflicted; and more accepting and loving of themselves and others during these years. On the negative side, however, some individuals feel overwhelmed as they increasingly recognize that they are no longer young and vibrant, that time is passing, that life's heaviest responsibilities are falling on them, that they must prepare for the future, and that some of their dreams may not be met. These individuals may question their accomplishments in life and conclude that they have achieved and will continue to achieve too little. In certain cases, they may even try to deny the passage of time and to recapture their youth, a phenomenon popularly labelled the *midlife crisis*.

Social and Emotional Features of Old Age

Due to longer life expectancies and declining fertility rates, the World Health Organization has stated that by 2050 nearly 2 billion people worldwide will be 60 years or older; this is nearly triple what it was in 2000 (World Health Organization, 2015). This changing demographic is of vital importance because "old age" is typically defined in our society as people who are 65 years old and above. Psychologists further distinguish between the young-old, people between 65 and 74; the old-old, those between 75 and 84; and the oldest-old, individuals 85 and above (Navarro & Calero, 2018). Many experts believe that rather than focusing on chronological age, functional age should be used to distinguish between groups of elderly people. In any case, using the current system, the old-old are the fastest growing age group in Canada. The over 85 year group tripled from 1981 to 2000, and it is estimated that by the year 2051 there will be over two million people in Canada in this age group, with over 20 percent of the population 65 and older (Driedger & Chappell, 2014). The majority of these people will be women.

Old age brings special pressures, unique upsets, and, as we saw earlier, profound biological changes. People become more prone to illness and injury as they age. They also are likely to experience the stress of loss—the loss of spouses, friends, and adult children, as well as the loss of former activities and roles (Mens, Scheier, & Wrosch, 2014). Some lose their sense of purpose after they retire.

Nevertheless, elderly people do not necessarily become depressed or feel overwhelmed (Gana et al., 2013). Indeed, Erikson believed that, for many, old age is characterized by accumulated knowledge and understanding and by mature judgment (Marcia, 2014). The goal of old age, he proposed, is to attain wisdom, a detached yet active concern with life in the face of death. Wisdom is achieved through the integration of insights gained from the past and the present regarding a person's place in the stream of life. Erikson believed that those who do not effectively meet the challenges of this stage may experience an extreme

fear of death or despair, show bitterness and disgust, and feel that time is too short. He therefore categorized old age as a conflict between *integrity* and *despair*.

Research indicates that many older persons do indeed use the changes that come with aging as opportunities for learning and growth (Dezutter, Wiesmann, Apers, & Luyckx, 2013). (See photo.) One case in point: one study demonstrated that the number of elderly—often physically limited—people who learned to use Facebook showed an increase in quality of life as they significantly increased communication with friends and family through the social media website (Coto, Lizano, Mora, & Fuentes, 2017; Haris, Majid, Abdullah, & Osman, 2014).

It is also worth noting that, despite the common themes of old age, the population of elderly adults is actually quite heterogeneous. That is, older adults are more *unalike* than similar to one another. Elderly people have very different life experiences, adapt to change in uniquely personal ways, and age at different rates. Thus, psychologists make a point of distinguishing between chronological age and functional age. *Chronological age*, or the number of years a person has lived since birth, is regarded as little more than a "short-hand variable" because it is not a true indicator of an elderly person's functional capacities. *Functional age*, however, reflects the individual's capacity to adapt his behaviour to the changing environment. This aspect of aging is influenced by a person's coping skills, social pursuits, emotions, motivation, and self-esteem, among other factors.

Dave Pratt/PA Wire/Associated Press

Active in old age For many, old age is a time to relax and focus on the things you enjoy. George Moyse, a 97-year-old man from Dorset, England, skydives strapped to an instructor after jumping from a plane flying at 10,000 feet.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

18. What is the difference between the wear-and-tear theory of aging and the free-radical theory of aging?

19. Describe and define Erikson's major crises of adult development.

What Do You Think? • Do you think that life experiences may actually increase adults' cognitive, or mental, abilities? Why might this be so?

Summary

How Is Developmental Psychology Studied?

LEARNING OBJECTIVE 1 Describe and discuss the advantages and disadvantages of cross-sectional and longitudinal designs for researching development.

Two major research approaches in developmental psychology are cross-sectional (comparing different age groups to assess change) and longitudinal (studying the same group to see how responses change over time).

The cohort-sequential research design combines elements of the cross-sectional and longitudinal approaches.

Understanding How We Develop

LEARNING OBJECTIVE 2 Understand the key debates underlying research and theory in child development.

Developmental psychology is the study of changes in our behaviour and mental processes over time and the various factors that influence the course of those changes.

Key philosophical issues in the study of developmental psychology are what drives change (biological or environmental factors); what is the nature of the change (qualitative or quantitative); and the role of early experiences in shaping later development.

Heredity and Prenatal Development

LEARNING OBJECTIVE 3 Discuss patterns of genetic inheritance and describe stages and potential problems during prenatal development.

Our genetic inheritance comes from both parents, who each contribute half our chromosomes. Genes can combine in various ways to make up our phenotype, or observable traits.

Genetics can influence the manifestation of both physical traits and psychological traits, including temperament, although environment also plays a role.

Prenatal development begins with conception and is divided into three stages: germinal, embryonic, and fetal, each characterized by specific patterns of development.

Individuals are susceptible to multiple influences by biological and environmental forces before they are even born, during the prenatal period.

Infancy and Childhood

LEARNING OBJECTIVE 4 Summarize the major physical, cognitive, and emotional developments that take place during infancy and during childhood.

Infants make dramatic gains in both physical and psychological capabilities. Our brains grow during this period, preparing us to learn and encode the information that will organize those changes.

One of the most important developmental theorists, Jean Piaget, proposed a theory of cognitive development that suggested that through learning and self-experimentation, we help our thinking to grow progressively more complex.

Piaget believed we pass through multiple stages on the way to formal adult reasoning and that each transition is accompanied by the acquisition of a new cognitive capability. During the sensorimotor stage in infancy, we become able to hold memories of objects in our minds.

Information-processing researchers have suggested that babies may develop mental capacities at earlier ages than Piaget believed they did.

Attachment theory suggests that babies are biologically predisposed to bond and form a relationship with a key caregiver, thus ensuring that their needs are met. The security of the attachment relationship will have later implications for how secure individuals feel in their emotional and social capabilities.

Baumrind found evidence that different parenting styles can also affect the overall well-being of the child, although subsequent research suggested that outcomes might vary depending on other environmental and cultural influences.

Physical growth continues at a generally slower pace in childhood than in infancy. Myelination and synaptic pruning continue to shape the brain.

Piaget believed that children pass through the stages of preoperational and concrete operational thinking, learning to manipulate their mental schema. Other researchers have suggested children's thinking may not be as limited during these stages as Piaget thought it was.

Theories of moral development often focus on moral reasoning (the reasons why a child would do one thing or another) rather than values. Generally, research supports the movement from morality rooted in submitting to authority to morality rooted in more autonomous decisions about right and wrong.

Some researchers suggest that moral reasoning may vary across gender and culture. Other researchers question whether morality theories would be better served by measuring behaviour instead of expressed reasoning or attitudes.

Adolescence

LEARNING OBJECTIVE 5 Summarize the major physical, cognitive, and emotional changes

that take place during adolescence.

Adolescence is generally associated with many substantial changes, including the onset of full sexual and physical maturity, as well as reasoning capabilities that approach adult levels. However, teenagers have certain limitations that influence their ability to make sound judgments and avoid risky situations.

Erikson proposed a theory of development that stretches across the lifespan and incorporates various dilemmas that need to be successfully reconciled for development to stay on track.

Adulthood

LEARNING OBJECTIVE 6 Describe the key physical, social, and emotional changes that take place throughout adulthood.

Adult physical and psychological development is often characterized by some degree of decline. However, most basic faculties remain intact across the lifespan.

According to Erikson, the challenge of early adulthood is to resolve the conflict between intimacy and isolation; of middle adulthood, to resolve the conflict between generativity and stagnation; and of old age, to resolve the conflict between integrity and despair. Levinson pointed out that transitions from one stage to the next can also cause conflicts.

The ages at which adults are expected to reach major social and emotional milestones, such as marriage and parenting, are more flexible now in many societies than they were in the past.

Key Terms

accommodation

allele

assimilation

attachment

cellular clock theory

cephalocaudal pattern

chromosomes

codominance

cognitive development

cohort-sequential design

concrete operational stage

conservation

critical periods

cross-sectional design
deoxyribonucleic acid (DNA)
developmental psychology
discrete trait
dominant trait
egocentrism
epigenetic
equilibrium
formal operational stage
free-radical theory
genes
genotype
habituation
heterozygous
homozygous
information-processing theory
longitudinal design
maturation
menopause
miscarriage
motor skills
myelination
object permanence
operations
phenotype
placenta
polygenic trait
prenatal period
preoperational stage
primary sex characteristics
proximodistal pattern
puberty
recessive trait

reciprocal socialization

reflexes

representations

scaffolding

scheme

secondary sex characteristics

stage

synapses

synaptic pruning

temperament

teratogens

theory of mind

violation-of-expectation

wear-and-tear theory

zone of proximal development

zygote

Self-Study Questions

Multiple Choice

1. What is the difference between a critical period and a sensitive period?

- **a.** Critical periods are more rigid than sensitive periods.
- **b.** Sensitive periods are more rigid than critical periods.
- **c.** Animals have sensitive periods, while humans have critical periods.
- **d.** Critical periods and sensitive periods are the same thing.

2. Which of the following is an advantage of cross-sectional research?

- **a.** Gives reliable information about age changes.
- **b.** Cohort effects are easy to separate.
- **c.** Explains how and when changes might have occurred.
- **d.** Is easy and straightforward.

3. A person's genetic code or inheritance is that person's

- **a.** phenotype.
- **b.** genotype.

c. gene.

d. chromosome.

4. The purpose of myelin is to

a. increase the number of synaptic connections.

b. eliminate excess synaptic connections.

c. help electrical impulses pass more efficiently.

d. allow colour vision to develop.

5. According to Ainsworth and Main's research into attachment styles, the majority of infants' attachment is

a. anxious/ambivalent.

b. secure.

c. anxious/avoidant.

d. emotionally close.

6. What area of research focuses on young children's beliefs about how their minds and the minds of others work?

a. theory of mind

b. metacognition

c. egocentrism

d. scaffolding

7. The gap between what children can accomplish by themselves and what they can accomplish with the help of others is called _____, according to Vygotsky.

a. scaffolding

b. zone of proximal development

c. reciprocal determinism

d. conservation

8. Students about to graduate from high school sometimes have difficulty deciding whether to go to college or university or go directly into the workforce. Which of Erikson's stages is relevant to this issue?

a. intimacy versus isolation

b. identity versus role confusion

c. industry versus inferiority

d. generativity versus self-absorption

9. Which theory of aging provides a chemical-oriented explanation?

a. wear-and-tear

b. free radical

c. cellular clock

d. use-it-or-lose-it

10. A non-genetic, or environmental, influence on gene expression is called a(n) _____ effect.

a. proximodistal growth

b. epigenetic

c. nature

d. synaptogenesis

Fill-in-the-Blank

1. A developmental jump, as opposed to slow and steady development, is called a _____ shift.

2. A _____ research design studies the same people over a significant period of time.

3. A _____ trait occurs when both parents contribute the same alleles for a gene.

4. The process that removes some of our early neural connections is called synaptic _____.

5. _____ refers to a child's understanding that things continue to exist even when out of sight.

6. In Piaget's theory of cognitive development, children aged 7 to 12 years are in the _____ stage.

7. According to Carol Gilligan, Kohlberg's assumption that the moral reasoning of girls is less well developed than that of boys is faulty because the moral reasoning of girls is oriented toward _____ rather than abstract principles.

8. The _____ gland controls the onset of puberty.

9. Our metabolism begins to slow when we are in our _____.

10. At virtually every age it is easier to determine a person's moral thoughts but harder to determine their moral _____.

CHAPTER 5
Sensation and Perception

Corina Marie Howell/Getty Images

CHAPTER OUTLINE

Common Features of Sensation and Perception

LEARNING OBJECTIVE 1 Describe characteristics shared by all the senses, including receptor cells, transduction, and thresholds, and differentiate between top-down and bottom-up processes of perception.

The Chemical Senses: Smell and Taste

LEARNING OBJECTIVE 2 Summarize the biological changes that underlie smell and taste.

The Tactile or Cutaneous Senses: Touch, Pressure, Pain, Vibration

LEARNING OBJECTIVE 3 Describe how the different senses of touch work and what can happen when things go wrong.

The Auditory Sense: Hearing

LEARNING OBJECTIVE 4 Summarize what happens when we hear.

The Visual Sense: Sight

LEARNING OBJECTIVE 5 Describe key processes in visual sensation and perception.

When you hear the word "river" do you feel angry or disgusted? Can you see a noise or taste a word? Some people experience involuntary and consistent links, or intermixing, between their sensory systems. This condition is called *synesthesia*. The name *synesthesia* comes from two Greek words: *syn*, meaning together, and *aesthesis*, meaning perception, and therefore refers to "*joined perception.*" People who have synesthesia experience a stimulus that typically would be perceived by one sense in most people in two or more

sensory modalities (Jäncke, 2013).

How many people have some form of synesthesia? This is a difficult question to answer because many people with synesthesia assume that the sensations they experience are also experienced by others and so the phenomenon often goes unreported. However, prevalence estimates range from as low as 1 in to as high as 1 in 23 people (Ward, 2013).

The most common form of synesthesia is called *grapheme-colour synesthesia*. A person who has this form of synesthesia always sees a colour in response to a specific letter or number (e.g., the number "9" is always perceived as turquoise, or the letter "J" is always perceived as orange) (Witthoft & Winawer, 2013). More recent work suggests that such perceptions are not always conscious (Ramachandran & Seckel, 2015). There are also synesthetes who smell particular odours in response to touch, or who hear noises in response to smell, or who feel a tactile stimulus in response to sight, whereas others experience unpleasant emotions elicited by specific sounds (Russell, Stevenson, & Rich, 2015; Colizoli, Murre, & Rouw, 2013; Cytowic, 2013). There are even some individuals who possess synesthesia involving three or more senses, but this type of synesthesia is very rare (Ward, 2015).

Neuroimaging studies have shown that sensory areas normally unaffected by particular stimuli are activated in a synesthetic experience (Yokoyama et al., 2014). For example, the auditory cortex and visual cortex of sight-sound synesthetes activate in response to particular visual stimuli. Thus the brain of a person who can hear a picture or colour responds as though the visual stimulus were also producing sound waves, as well as reflecting light waves. Other research suggests that the phenomenon may not be strictly sensory for at least some forms of synesthesia, but may also be semantic (that is, based on perception) (Mroczko-Wasowicz & Nikolic, 2014). For example, in one study grapheme-colour synthesetes were shown two identical stimuli but were told in one case that they were looking at the number "5" and in another case that they were looking at the letter "S." The person's sensation of colour changed based on whether they perceived the stimulus to be a number or a letter (Sinke et al., 2014).

Although the majority of individuals do not have synesthesia, we all detect physical energy from the environment and change it to a neural code to be used in the brain to perceive the world. This chapter will address questions related to how our sensory systems make sense of the physical world. Why does the world appear stationary as you walk through it? Why does food taste different when you have a cold? Why does something appear red when the light is on and appear to have no colour when the light in the room is dim? Why can some people walk across red hot coals in their bare feet without seeming to experience pain?

We are surrounded by energy in our environments at all times, including electromagnetic energy such as radiant heat and ultraviolet and infrared light, and mechanical energy such as pressure or sound waves of varying intensity. Our sensory systems are able to detect only some of this energy. However, all that we experience is dependent on the electrical signals generated by the nervous system. That is, everything that we experience, every taste, every smell, every sight, every sound, and every feeling, is based on the energy absorbed by our sensory receptors and converted to neural impulses that are transmitted to the brain (Goldstein & Brockmole, 2016). As a consequence, much of what happens in the world goes unrecognized by our perceptual systems.

Two closely related processes are involved in sensory perception. One is **sensation**, the act

of using our sensory receptors to detect a stimulus present in the environment and to then transmit a signal to the brain with information about this environmental stimulus. Transformation of physical energy from the environment into electrical signals for the brain occurs in a process called transduction. Once acquired, this sensory information must be interpreted in the context of past and present sensory stimuli. This process, which also involves recognition and identification, is broadly defined as **perception**.

sensation the act of using our sensory systems to detect environmental stimuli.

perception the conscious recognition and identification of a sensory stimulus.

Sensation *and* perception are both critical for our interpretation of, and interaction with, the environment. Accurate functioning of our sensory systems is critical for survival. For example, imagine how greatly diminished your chances of survival would be if you could not see a fire, feel its heat, hear others crying "fire," smell the smoke, or interpret any of these sensations and perceptions appropriately as signalling danger.

Common Features of Sensation and Perception

LEARNING OBJECTIVE 1

Describe characteristics shared by all the senses, including receptor cells, transduction, and thresholds, and differentiate between top-down and bottom-up processes of perception.

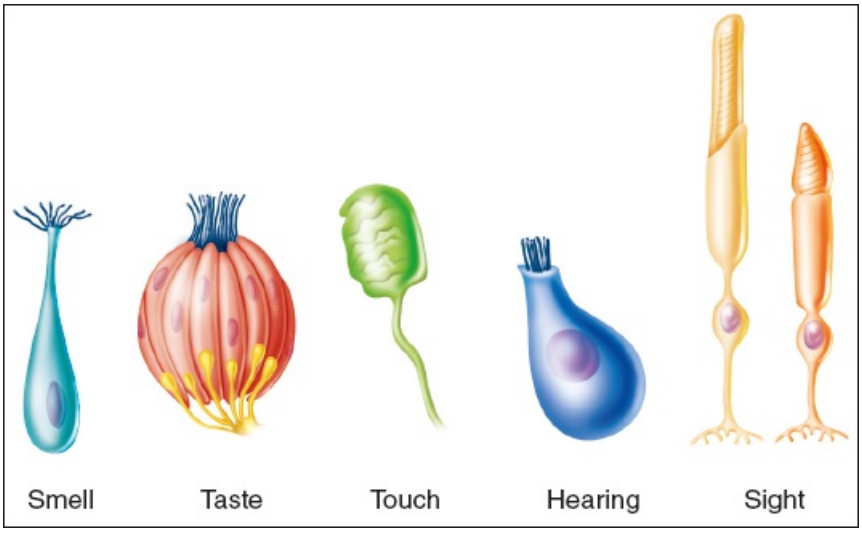


FIGURE 5.1 Sensory receptor cells **Each sensory system contains specialized cells that are activated by particular physical stimuli.**

TABLE 5.1

How Sensory Transduction Converts Environmental Stimuli into Neural Activity	
Sensory System	**Physical Stimuli**
Olfactory (smell)	Odorants (airborne chemicals)
Somatosensory (touch, heat, pain)	Pressure or damage to the skin
Gustatory (taste)	Chemicals (typically in food)
Auditory (hearing)	Sound waves
Visual (sight)	Light (photons)

Each of our sensory systems is set up to convert a narrow window of the physical stimuli we receive from the world we perceive outside our bodies into electrical neural signals that can be used by the brain. Sensation and perception occur differently in each of our sensory modalities, but our senses also share some common processes. Each of the senses has a set of specialized cells called **sensory receptor cells** that convert a specific form of environmental stimuli into neural impulses, the form of communication used in our brains and nervous systems (see **Figure 5.1**). This conversion is called **sensory transduction**. **Table 5.1** lists the different physical stimuli for each sensory system that are converted to brain activity through sensory transduction.

> **sensory receptor cells** specialized cells that convert a specific form of environmental stimuli into neural impulses.
>
> **sensory transduction** the process of converting a specific form of environmental stimuli into neural impulses.

The Limits of the Senses: Thresholds

Our sensory receptors can be activated by very weak stimuli. A stimulus must, however, reach a certain level of intensity (called a **threshold**) before we can detect it, because the conversion of physical stimuli into neural impulses only occurs when the stimuli reach this level or threshold. The minimal stimulus necessary for detection by an individual is called the **absolute threshold** (**Table 5.2**). Although the absolute threshold varies from person to person, in most cases it is surprisingly small. For instance, many normal humans are capable of detecting a candle flame up to 50 kilometres away on a pitch black clear night (Galanter, 1962). Anything that falls below the sensory threshold goes unnoticed. Since people cannot always be certain that they have identified a very weak stimulus, researchers have defined absolute threshold as the lowest intensity at which a stimulus can be accurately identified 50 percent of the time. Researchers have also worked to determine the smallest difference that we can detect between two stimuli, called the **difference threshold** or **just noticeable difference**. If you are listening to music on your iPhone, how much do you have to turn up the volume before you notice that the music is louder? This amount, or just noticeable difference (jnd), depends on how loud the music was in the first place, how noisy your surroundingss are, how attentively you are listening, etc. When sensory systems are working optimally, the difference threshold is also remarkably small. Levels of discrimination are dependent on other factors also. For example, a professional

wine taster can discriminate greater nuances in wines than you are probably able to detect.

threshold the point at which the magnitude or intensity of a stimulus initiates a neural impulse.

absolute threshold the minimal stimulus necessary for detection by an individual 50 percent of the time.

difference threshold or **just noticeable difference** the minimal difference between two stimuli necessary for detection of a difference between the two.

Absolute and difference thresholds assume that every person has a fixed level for sensitivity. But sensitivity fluctuates depending on perceptual processes, such as experience, expectations, and consequences for failure. Such response criteria, known as signal detection criteria, are necessary because detection of signals usually occurs in noisy environments. Here "noise" refers to extraneous information that interferes with a signal. For example, if you are trying to smell the milk to determine whether it is sour, the task of smelling the milk is less "noisy" if you are standing alone in the kitchen than if you are standing in the kitchen with your roommate who is wearing cologne and making a tuna sandwich while fresh coffee is brewing. As well, people use response criteria to determine how certain they need to be before they acknowledge the detection of a stimulus (Szalma & Hancock, 2011). For example, if you make a mistake and assume that the milk is safe and you are wrong, you end up drinking a bit of the sour milk. However, the consequence of drinking sour milk is not dangerous. Compare that situation with how careful you would need to be if instead you had to detect whether the week-old chicken in the refrigerator was still safe to eat. If uncertain in either situation, you might be willing to taste the milk, but you would be less willing to try the chicken. As shown in **Figure 5.2**, **signal detection theory** argues that when the intensity of the stimulus is low (weak), both situational characteristics and the participant's response criteria will influence decisions (the outcome) (Batchelder, Colonius, & Dzhafarov, 2018; Cataldo & Cohen, 2015). Thresholds may limit our abilities in some ways, but they are also very useful to us. For example, imagine how distracting it would be if you noticed minor changes in wind pattern or each individual fibre in your clothing. You probably wouldn't be very comfortable if you noticed every small detail in your environment, nor would you be able to focus on what was most important.

signal detection theory Theory that the response to a signal in every situation depends on an individual's ability to differentiate between the signal and noise, and on their response criteria.

TABLE 5.2

Absolute Thresholds for Various Senses

Sense	Absolute Threshold
Smell	A drop of perfume diffused throughout a six-room apartment

Taste	5 millilitres of sugar in 9 litres of water
Touch	An insect's wing falling on your cheek from a height of about a centimetre
Hearing	The tick of a watch at 6 metres in a quiet room
Sight	A candle flame 50 kilometres away on a clear, dark night

Surrounded by Stimuli: Sensory Adaptation

Our senses are generally organized to detect change. This makes adaptive sense since a great deal of the stimuli we are exposed to are not important enough to warrant our attention. Imagine how difficult it would be to concentrate on reading this chapter if sensory information about the odours in your environment, the taste of your mouth, the sound of the clock ticking, the sensations of blinking and breathing, and the touch of your clothing were all competing with your ability to read! To combat the possibility of being unable to focus on the salient or important cues, our sensory systems respond to the continual presence of the same stimulus or to a repetitive stimulus with a decreased response to that stimulus, a process called **sensory adaptation**. What happens is this: when some stimulus in our surroundings stays the same for a period of time, such as the pressure of our clothing on our skin, our sensory cells respond to it less and less. This response keeps the brain from being overloaded with redundant information. After a time, in some cases we no longer notice the stimulus at all. All of our sensory systems exhibit some form of adaptation, but the sense of smell is particularly sensitive to adaptational effects (Mather, 2016).

sensory adaptation the process whereby repeated stimulation of a sensory cell leads to a reduced response.

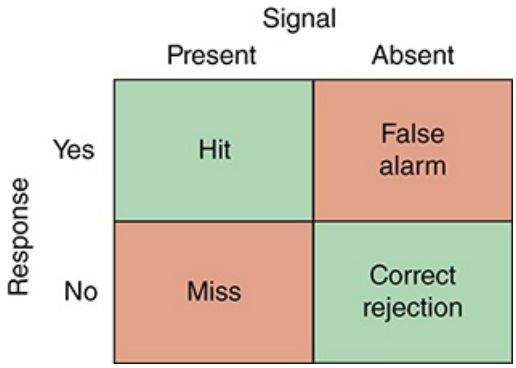


FIGURE 5.2 Signal detection theory In a signal detection experiment, participants might be told that following a warning tone, a barely susceptible light may or may not be presented. The participants must tell the experimenter whether they see the light by responding "Yes" or "No" in every trial. When the light is present, and the participant responds "Yes," the outcome is recorded as a "hit," but if the participant answers "No," then the outcome is recorded as a "miss." If the light is not presented and the participant responds "Yes," then the outcome is presented as an "alarm." If the light is not present and the participant responds "No," then the

outcome is recorded as a "correct rejection."

Olfactory adaptation occurs when a change in sensitivity to a particular odour reaches a point where the odour cannot be distinguished after a prolonged exposure to it. That is, our ability to detect specific odours gradually fades when we are in their presence for a prolonged period. Sensory adaptation can be overcome by providing a much stronger stimulus. Something like this may have happened to you when you were at Starbucks or Tim Hortons. When you first entered the shop you probably smelled a strong odour of coffee. After a time you no longer noticed this odour. However, when the barista brings you your own cup of coffee, you are once again able to savour the smell of coffee. Now that the source of the smell is more concentrated in your vicinity, your ability to smell the odour is renewed. Although the sense of smell is perhaps most prone to this response, all of our sensory systems exhibit some form of adaptation (Goldstein & Brockmole, 2016).

Processing Sensory Information

Sensation and perception almost always happen together. Researchers, however, have studied each process separately to determine how the two work together. Perception can occur through **bottom-up processing**, which begins with the physical stimuli from the environment, and proceeds through transduction of those stimuli into neural impulses. The signals are passed along to successively more complex brain regions, and ultimately result in the recognition of a visual stimulus. For example, when you look at the face of your best friend, your eyes convert light energy into neural impulses, which travel into the brain to visual regions. This information forms the basis for sensing the visual stimulus and ultimately its perception. Equally important to perception, however, is **top-down processing**, which involves previously acquired knowledge. As a result, when you look at your best friend's face, brain regions that store information about what faces look like, particularly those that are familiar to you, can help you to perceive and recognize the specific visual stimulus.

> **bottom-up processing** perception that proceeds by transducing environmental stimuli into neural impulses that move into successively more complex brain regions.
>
> **top-down processing** perception processes led by cognitive processes, such as memory or expectations.

The power of top-down processing goes far beyond just using our memories to recognize our best friend's face. Knowledge about how things typically appear, our perceptual expectations, or **perceptual sets**, can actually prepare us to perceive certain things in particular ways. For example, a photo showing a fuzzy UFO will look very different to you depending on whether you believe in UFOs. And perceptual sets do not relate only to vision. Consider, for example, whether a dish would taste exactly the same to you if you thought it was chicken or if you thought it was rattlesnake. Many elements—our experiences, our cultures, the contexts in which we find ourselves—affect our perceptual sets.

> **perceptual set** readiness to interpret a certain stimulus in a certain way.

Perceptual sets may come into play when we are faced with *ambiguous stimuli*—stimuli that could be interpreted in different ways. A well-known visual example is presented in **Figure 5.3**. Looked at one way, the drawing shows a young woman looking over her shoulder—you can see her jawline, her ear, and a bit of her nose. Looked at another way, it shows an old woman with her chin to her chest. If someone pointed out this drawing to you by saying, "Look at this picture of an old woman with a big nose," that's most likely what you would see—because that's what you would expect to see.

FIGURE 5.3 Old or young? What you see when you look at this drawing depends in part on what you expect to see.

Typically, perception involves both *bottom-up* and *top-down* processing occurring at the same time. The combination lets us rapidly recognize familiar faces and other stimuli. Bottom-up and top-down processing are involved in sensation and perception of all sensory modalities. For example, recognizing familiar songs involves not only information carried from the ear to the brain, but also the matching of that information with previously stored information about the music. We also combine bottom-up and top-down processes to help us recognize the smell or taste of a familiar food, and to put a name to a face, and so on.

RADIOLOGIE P.BROUSSE-GARO/Phanie/Alamy Stock Photo

A critical difference **A radiologist carefully examines a brain scan looking for minute changes in the images. An individual's ability to detect a difference between two visual stimuli (such as normal versus abnormal tissue) can be increased by special training, practice, and instruments, but it is still limited to some degree by sensory difference thresholds.**

The Senses

Sensory systems are a part of the nervous system consisting of sensory receptors that receive stimulus information and conduct information to parts of the brain responsible for processing sensory information (see photo). Each system consists of sensory receptors, neural pathways, and areas of the brain involved in sensory perception.

Aristotle was the first to claim that there are five senses: smell, taste, touch, sound, and sight. However, beyond these five senses we can also consider our kinesthetic sense, which gives us information about the body's movement, posture, and position. As well, the vestibular sense gives us information about the head's position and movement in space, stabilizing gaze as well as maintaining balance and posture. Together, these two senses, as well as other senses (particularly the visual system), combine to provide proprioceptive feedback, sometimes considered the body's sixth sense. Proprioceptive feedback is the unconscious awareness of the self and spatial orientation arising from stimulation within the body. Although we will discuss each of these major sensory systems separately in this chapter, in most of our day-to-day experiences, we actually use these sensory systems or modalities in combination to experience the world (Gazzaniga & Mangun, 2014; Loewenstein, 2013).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

1. What is sensory transduction?
2. What are absolute and difference thresholds?
3. Compare and contrast bottom-up and top-down processing.

What Do You Think? • Describe examples of sensory adaptation that you have experienced in two or more of your sensory modalities.

The Chemical Senses: Smell and Taste

LEARNING OBJECTIVE 2

Summarize the biological changes that underlie smell and taste.

Smell and taste are separate senses but are usually together called the *chemical senses* because they involve responses to particular chemicals (Armelin-Correa & Malnic, 2017). Smell, our **olfactory sense**, and taste, our **gustatory sense**, emerged early in our evolutionary history (Doty, 2015). The sense of smell, in particular, is more sensitive and of greater significance to less complex animals, who use it for social communication as well as finding food and avoiding predators (Breslin, 2013; Stevens, 2013). This is less so for humans who rely more heavily on vision (Valentin, 2015). However, the contributions of both smell and taste to the safety, social communication, and overall quality of life in humans are often underestimated. The ability to detect dangerous odours, such as smoke or a gas leak, or dangerous flavours, such as tainted food or poison, can be critical to our survival. In addition, some of our greatest pleasures in life come from the ability to smell and taste—to smell a rose or, as we all know, to enjoy a good meal.

olfactory sense our sense of smell.

gustatory sense our sense of taste.

In this section, we will explore the environmental stimuli that create aromas and flavours, the organs we use to sense those stimuli, and how we transform environmental stimuli into brain signals that eventually help us perceive different smells and tastes. We will also discuss the development of these abilities, some very interesting differences among people in their ability to taste and smell things, and some problems that can occur in the olfactory and gustatory systems.

Smell and Taste: How They Work

Smells Around Us

Sensation in the smell or olfactory system begins when chemicals called **odorants** enter the nose, as shown later in the chapter in the feature "Your Brain and Behaviour 5.1." Odorants are converted to neural signals at sensory receptors located in our nasal mucosa. These sensory receptors are located on the *cilia*, or hairlike structures, of **olfactory**

receptor neurons (Scott, McBride, & Schneider, 2016).

> **odorants** airborne chemicals that are detected as odours.
>
> **olfactory receptor neurons** sensory receptor cells that convert chemical signals from odorants into neural impulses that travel to the brain.

When odorants enter the nose, these chemicals bind to specific receptors located on the olfactory receptor neurons in a lock-and-key fashion. Only certain airborne chemicals bind to specific receptors (Doty, 2015). When enough odorant molecules have bound to receptors, the combination sets off an action potential in the olfactory receptor neuron. As we described in Chapter 3, the action potential or *firing* of a neuron sends a message to other neurons. The firing of olfactory receptor neurons is transmitted to the brain, as we will see next.

Continuous binding of certain odorants will result in fatigue of the olfactory receptor neurons to which they bind. In other words, the cell will stop responding to the odorant unless it's given a chance to recover so it can fire again (Mather, 2016). If you were to step outside a restaurant to make a phone call, for example, you would probably notice the food smells again when you stepped back into the restaurant because your olfactory receptor neurons would have gotten a break from constant exposure to the food odorants. When a stimulus is continuously present, however, such as when you remain sitting in the restaurant, the only way the olfactory receptor neurons will respond to the odorant would be if the stimulus increases in magnitude, such as when the food is brought directly to your table. Many more odorant molecules are now available to your nose and its olfactory receptor neurons.

Types of Tastes

In humans, the sense of smell is very closely tied to the sense of taste. In fact, what we normally call *taste* is really *flavour*, which is a combination of smell and taste. However, taste, the gustatory sense, is itself independent of smell. The top of the tongue, the major organ of taste, is covered with bumps, called **papillae**. As shown in **Figure 5.4**, papillae contain clumps of **taste buds**, each of which contains 60 to 100 sensory receptor cells for taste.

> **papillae** bumps on the tongue that contain clumps of taste buds.
>
> **taste buds** clusters of sensory receptor cells that convert chemical signals from food into neural impulses that travel to the brain.

Taste receptor cells have cilia that contain the actual receptors. These cilia extend through the pores of the taste receptor and are exposed to the contents of your mouth.

There are five major kinds of taste receptors. Each responds to a specific taste in our food: sweet, sour, bitter, and salty (Mather, 2016; Kikut-Ligaj & Trzcielińska-Lorych, 2015). The fifth type of taste receptor is called *umami*. Umami was first identified by a chemist, Kikunae Ikeda, at Tokyo University in 1908. Umami is a pleasant, savoury taste associated with glutamate. Eventually, Dr. Ikeda developed and patented a flavour enhancer now

called MSG (Ninomiya, 2016; Kurihara, 2015). Each of these five types of taste receptors uses a slightly different mechanism for transduction of the chemicals in food to neural impulses in the gustatory system. For example, salt activates its taste receptors by sending sodium ions into the channels on the taste receptor cell. Since sodium ions are positively charged, the electrical charge of the taste receptor then becomes more positive. Taste buds are not evenly distributed across the tongue, but most tastes can be recognized to a greater or lesser degree on most parts of the top of the tongue (Dias et al., 2013).

Eating: It's More Than Smell and Taste

The overall sensations we experience when we eat food are not just the result of combined interactions between olfactory and gustatory senses. Much of the information we get about food is delivered to us through one of the touch or *tactile* senses. The consistency of a particular food is not relayed to the brain via the taste receptors, but rather by inputs from touch receptors located on the tongue. The role of food consistency in determining preference is much greater than you might imagine. Many adult humans reject certain foods, such as raw oysters or cooked okra, specifically because those foods have a "slimy" texture.

In addition, the sensation we experience when we eat a spicy meal is related to a component of the tactile system that communicates information about pain. A chemical called *capsaicin*, from chili peppers, activates pain receptors located in the tongue (Rolls, 2015). These pain impulses, in conjunction with tactile information about the food texture, as well as the flavours (smell and taste) associated with the food, can combine to produce a sensation that is pleasurable to many people.

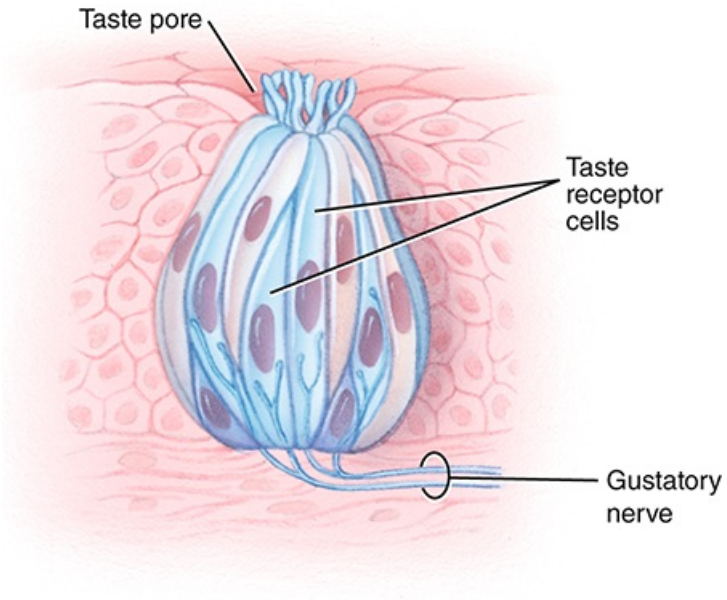


FIGURE 5.4 One of 9,000 taste buds in the human system The receptor cells for taste are clustered within the taste buds found in the bumps, or papillae, covering your tongue.

Conversely, sometimes a food is hot because it just came out of the oven. Most of us have

had the experience of burning our mouths. This type of burn can damage the taste receptors on the tongue. The sensory receptors of taste are unusual because they regenerate when this happens (Fan et al., 2014).

How the Brain Processes Smell and Taste

Signals from our olfactory receptor neurons travel to the brain via the olfactory nerve. As **Figure 5.5** shows, information carried along the olfactory nerves travels first to a structure called the **olfactory bulb**, located at the base of the front of the brain, beneath the frontal lobes. Olfactory information is then sent to regions of the cerebral cortex that are important for recognizing and discriminating among odours, including the piriform cortex (Osmanski et al., 2014).

> **olfactory bulb** the first region where olfactory information reaches the brain on its way from the nose.

The ability of our cortex to recognize patterns of inputs from a variety of olfactory receptors is most likely responsible for our detection of certain odours. Studies have shown that the piriform cortex is *plastic* or changeable in adulthood (Li, 2014). That is, the parts of piriform cortex that normally recognize specific odorants can change with experience, actually remapping this brain region. The chemical structures of some pairs of molecules are so similar that untrained humans can't discriminate between them (the two odours are usually below the just noticeable difference). However, if exposure to one of the chemicals is paired with a painful shock to the leg, humans can be taught to discriminate between the odours (Li, 2014). This is a remarkable example of top-down processing. Learning about associations between odours and other experiences (such as a shock) can influence our ability to perceive sensory information in the future.

The olfactory bulb also sends information to the amygdala, an area important for emotions and fear, as well as indirectly to the hippocampus, an area important for learning and memory. Many people report that certain smells evoke past memories (Köster & Mojet, 2017). For example, the smell of baking might remind you of visiting your grandmother as a young child, the smell of school paste and old lunches might remind you of your elementary school, and so on. The ability of smells to retrieve memories is probably related in part to olfactory connections to the hippocampus and amygdala (Arrigo et al., 2017).

Taste receptor cells do not have axons, but instead connect with sensory neurons in the tongue to send information to our brains. Taste information is sent to the *thalamus*, and eventually, the cerebral cortex. We will see throughout this chapter that the thalamus is a relay station for incoming sensory information of many kinds; all of our sensory systems except olfaction have a main pathway through the thalamus (Yeung et al., 2016).

Taste information is integrated with reward circuits in the brain (Carr, 2016), and rewarding tastes seem to be processed separately from aversive tastes. Tastes that are considered to be rewarding, such as salty and sweet, activate overlapping areas in the taste cortex.

By contrast, tastes generally considered to be less pleasurable, such as bitter and sour, activate regions that overlap less with rewarding tastes and more with one another in the

taste cortex (Goldstein & Brockmole, 2016). Taste and smell information is processed through separate pathways, but there is convergence in the associated parts of neocortex, namely in the prefrontal cortex.

In addition to integrating information about taste in general, part of the cortex that receives taste information, called the *insula*, is associated with the emotion of disgust. Neuroimaging studies have shown that this brain region becomes activated not only when we smell or taste something revolting, but also when we view repulsive visual images (Papagno et al., 2016).

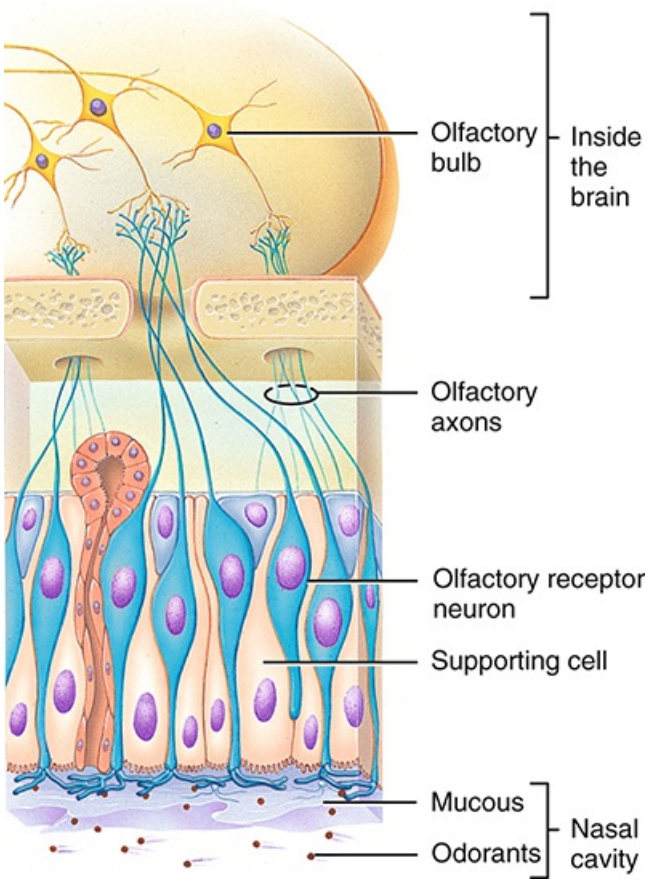


FIGURE 5.5 The smell route Olfactory receptor neurons (shown here in blue) transduce information from odorant molecules that enter the nose. This information is carried by the olfactory nerve into the brain where it synapses in the olfactory bulb.

The Development of Smell and Taste

The sense of smell is relatively well-developed at birth. Research suggests that, within hours of birth, newborn babies are capable of telling their own mother from another woman using only the sense of smell. In fact, olfactory functioning seems to be in place even before birth. Newborn infants show a learned preference to the odours of their mother's amniotic fluid. After birth, infants quickly learn to recognize the smell of their own mother's milk. Exposure to odours of their mother's milk has a calming effect on infants when they are experiencing a brief, minor painful stimulus, such as a needle stick in

the heel (Badiee, Asghari, & Mohammadizadeh, 2013). This effect doesn't appear to be as specific to the milk as it is to the mother—exposure to other odours that the baby has associated with the mother, such as the smell of their mother's perfume (e.g. the odour of a rose), can have the same calming effect as their mother's milk odour (Jebreili et al., 2015). (See photo.)

bulentumut/Getty Images

Pucker up! Babies are able to recognize both sweet and sour tastes but prefer sweet tastes until they are older.

The ability to taste is also well-formed in humans at birth (Spielman & Brand, 2016). Newborn humans show an innate preference for sugar and aversion to bitter or sour tastes. Babies move their faces toward a sweet substance and make sucking movements with their mouths, but turn away and grimace when presented with a sour or bitter substance (Forestell, 2016). (See photo.)

Researchers have shown that by about 7 years of age, children develop a preference for sour tastes (Forde, 2016). This may explain the popularity of candies such as Sour Patch Kids. However, the aversion to bitter tastes typically lasts until young adulthood when bitter foods, such as blue cheese and dark chocolate, start to emerge as favourites.

Many of these developmental changes are the result of learning. As children grow, they become accustomed to different tastes. However, there is some evidence to suggest that the gustatory system itself changes from infancy to adulthood. We form taste buds before we are even born, and as newborns, have higher concentrations of them on our tongues than we will as adults. Children also have taste buds on their palates, inside the cheeks, and at the back of their mouths. Although these regions continue to contain taste buds in adults, their numbers decline with time (Doty et al., 2016). (See Practically Speaking 5.1.)

The high number of taste buds in children may explain why they are often picky eaters. The tastes of certain foods may seem too strong to children because their larger number of taste buds produce more neural impulses than adults would generate from the same food. Some researchers suggest that this developmental phenomenon might actually be adaptive in helping us survive (Buss, 2015). If young children enjoyed ingesting substances with strong or bitter tastes, they might be at higher risk of poisoning.

Source: Bronwyn8/iStockphoto.com

Infants and odours **Exposure to odours that an infant associates with her mother can have a calming effect.**

Individual Differences in Smell and Taste

Have you ever felt a bit faint when you were closed in an elevator with someone wearing perfume, while others in the elevator seemed not to notice? Humans vary greatly in their ability to detect certain odours. Some people seem relatively insensitive to even very strong smells, while others seem very sensitive. Some of these individual differences are related to learning. Exposure to particular odours during childhood lessens the reaction to those odours in adulthood.

5.1 Practically Speaking

Regeneration in the Taste and Smell Systems

If you, like most people, have had the experience of burning your tongue on too-hot food or drink, you've probably noticed that by the next day or so, your ability to taste has returned and your tongue is no longer painful. This is due to the remarkable regenerative characteristics of the taste buds. Taste receptor cells normally regenerate —they die and are replaced—in a matter of days. The process happens even faster when they are damaged. Under normal circumstances, our olfactory receptor neurons are also constantly turning over (Bermingham-McDonogh & Reh, 2011; DeVere, 2017).

The capacity to regenerate on such a large scale and so rapidly is probably necessary because the receptor neurons for both taste and smell are exposed to the external environment. Unlike the sensory receptors of the eye, which are protected by the eyeball, or those of the ear, which are protected by the eardrum, the surface of the tongue and the mucosa of the nose are exposed to any number of noxious chemical molecules that may directly enter our mouths or noses. Because destruction of receptors is likely under such circumstances, we need to constantly regenerate receptor cells just to continue normal functioning of our smell and taste systems.

Neurobiologists are studying the regenerative capabilities of the taste buds and olfactory receptor neurons in hopes of understanding exactly how these cells are constantly rejuvenating (Finger & Barlow, 2021; Yang, He & Hao, 2015). Scientists and medical professionals hope that understanding these mechanisms both in healthy and non-healthy systems (Beecher, St John & Chehrehasa, 2018) may one day enable replacement of other cell types in other systems, particularly ones that don't seem capable of repair when damaged. For example, Young and colleagues (2018), are examining whether stem cells in the olfactory mucosa can be used to treat auditory nerve damage and Lu and colleagues (2018) hypothesize accelerating the return of taste sensations in cancer patients through pharmacologic activation of neuronal pathways.

In addition to these learned differences, research suggests that females are generally more sensitive to smell than males are, and that this sensitivity varies with the stage of the menstrual cycle (Derntl et al., 2013). Around the time of ovulation, women are more sensitive to odours than during other stages of the cycle. Women's ability to detect different odours also diminishes after menopause (Ruth & Murray, 2016; Barbieri, 2014). The exact biological mechanisms that underlie these differences are not known, but it is possible that reproductive hormones, such as estrogen, alter the excitability, or the likelihood, of firing of olfactory neurons (Hoyk et al., 2014).

There is also considerable individual variability in the ability to taste. Researchers group people into three different categories with respect to taste sensitivity: non-tasters (25 percent of people), medium tasters (50 percent), and supertasters (25 percent). These groups are distinguished based on their ability to detect and respond negatively to a specific bitter substance (Graziose, 2016). Supertasters are repulsed by the bitter chemical. Non-tasters do not even notice the bitter taste, although they are capable of detecting other tastes. Medium tasters notice it, but do not find the taste particularly offensive. These functional differences are the result of variations in the concentration of taste buds on the tongue.

Women make up a higher proportion of supertasters than do men (Pickering, Jain, & Bezawada, 2013). This heightened sensitivity of both chemical sensory systems, smell and taste, is likely to have had adaptive significance for women. Since the chemicals in women's diets are passed along to their children when women are pregnant or nursing, the ability to detect and avoid potentially harmful odours and tastes may have contributed to survival of the species by protecting infants from toxic substances.

Finally, the number of taste buds starts to decline at about 50 years of age, and the sense of smell may decline starting at age 60. A consequence of these two declines may be a gradual loss of interest in food, which can be counteracted by adding taste to food by way of spices by offering a wider variety of flavourful food choices (Landi et al., 2016).

Hoberman Collection / Getty Images

A special gift? Sommeliers learn to distinguish wines based on subtle differences in the wine's aroma or taste.

Smell and Taste Disorders

In some rare cases—typically as a result of head trauma or problems during oral surgery—humans lose the ability differentiate tastes, a condition called **ageusia**. More commonly, individuals suffer from dysgeusia, which is often associated with phantom taste perceptions that leave a foul, salty, rancid, or metallic aftertaste in the mouth. This can be temporary and is often associated with cancer treatments, dental problems, medications, or head injuries (Brondel et al., 2016).

ageusia inability to taste.

True taste disorders are rare. In fact, most people who seek medical assistance complaining that they cannot taste are actually suffering from problems with their olfactory, as opposed to gustatory, systems. People with a condition called **hyposmia** have a reduced ability to smell, whereas people with a condition called **anosmia** have lost the ability to smell. They can often still taste sweet, salty, sour, bitter, and umami, but they can no longer detect other flavours, since those require the additional information provided by food odorants.

hyposmia reduced ability to detect odours.

anosmia inability to detect odours.

Head trauma is also a leading cause of anosmia (Schofield, Moore, & Gardner, 2014). Sometimes the nerves that carry olfactory information from the olfactory receptor neurons to the olfactory bulb can be sheared, cutting off the pathway by which information about smell reaches the brain. People with Alzheimer's disease also suffer from a diminished sense of smell that is probably due to a combined degeneration of olfactory receptor

neurons and neurons located in olfactory brain regions (Westervelt, Bruce, & Faust, 2016). Recently, a majority of patients with mild COVID-19 were displaying symptoms of hyposmia and anosmia (see Psychology Around Us 5.1).

Although humans can certainly survive without the ability to smell, their quality of life is considerably diminished. Many people with anosmia report feelings of depression (Kohli et al., 2016). Moreover, socially acceptable cultural practices of hygiene may become difficult to follow with anosmia, since humans often use olfactory cues to make decisions about bathing, washing clothes, and brushing teeth. In addition, there are safety and social issues to consider. Since we use our sense of smell to detect dangers, such as smoke or spoiled food, anosmia increases the risk of injury. People with anosmia can learn to cope effectively with their condition by using other sensory systems to detect danger (Scangas & Bleier, 2017). They might, for example, use sound cues, such as a blaring smoke detector to notice smoke, or visual cues, such as appearance and freshness dates, to detect spoiled food.

5.1 Psychology Around Us

Hyposmia/Anosmia Associated with COVID-19

Hyposmia is a reduced ability to detect odours whereas anosmia is an inability to detect any odours at all. Lechien et al. (2020) and Krajewska et al. (2020) report that 66 percent of patients with primarily mild to moderate cases of COVID-19 describe experiencing some degree of hyposmia/anosmia either prior (11.8 percent), during (22.8 percent), or after (65.4 percent) experiencing other nasal inflammatory symptoms (e.g., earache, sore throat, difficulty swallowing, hearing impairment, post nasal drip, or difficulty swallowing). Some COVID-19 patients have been identified without any presenting symptoms other than anosmia. Krajewska et al. speculate that such individuals may be carriers of the coronavirus.

Lechien et al. invited patients with self-reported rapid onset of olfactory dysfunction (OD) and other clinical symptoms suggestive of COVID-19 to participate in their study. Patients' symptomology was verified through positive results either from a COVID-19 swab or through antibody testing (positive IgG or IgM). Online questionnaires were used to collect demographic data (age, gender, etc.) as well as medical information. Medical information regarding general symptoms (such as fever, cough, fatigue, and body aches) as well as ear, nose, and throat symptoms (such as sore throat, ear pain, and dysgeusia) were collected and rated with scores ranging from no symptom to severe symptom. Patients also completed rating scales on the impact of symptoms, quality of life, and other health questions related to comorbid health conditions (asthma, hypertension, etc.). Patients also completed a validated objective olfactory test, "Sniffin sticks," for OD wherein they identified 16 different scents (Hummel, Kobal, Gudziol, & Mackay-Sim, 2007).

Results indicate that 62 percent of patients with self-reported OD demonstrated anosmia or hyposmia when measured using the objective olfactory test. As well, the majority of patients with confirmed OD had no other nasal inflammatory symptoms, suggesting that further research is needed to determine the underlying pathophysiological causes of anosmia and hyposmia in COVID-19.

Migraines, Epilepsy, and the Sensory Systems

The chemical senses are also involved in the symptoms of some people with migraine headaches or epilepsy. For instance, a specific odour can initiate the onset of a migraine (Jion, Grosberg, & Evans, 2016). Likewise, patients with a certain form of epilepsy, called *reflex epilepsy*, will experience a seizure only after exposure to a specific odour (Ilik & Pazarli, 2014). Although the reasons for this remain unknown, these individuals find it necessary to avoid specific intense odorants. In other patients suffering from migraines or epilepsy, stimuli from the other sensory systems, such as touch, sound, and sight, can initiate the headaches or seizures.

Some people experience hallucinations called *auras* either before or during migraine headaches or epileptic seizures (Viana et al., 2016; Wolf, 2016). Auras can involve any of the sensory systems. People with these conditions might have touch, sound, or sight hallucinations, and some experience strong, often unpleasant, smells or tastes (see photo). The involvement of different senses indicates which brain circuits are compromised in these conditions. For example, if a person's seizure is preceded by strong olfactory hallucinations, it's likely that the olfactory pathways are initiating the seizure, or at least participating in its generation (Wolf, 2016).

alvarez/Getty Images

Migraines and the senses **Migraine sufferers often experience sensory distortions—for example, a strange light or unpleasant smell—just before or during their headaches. In some cases, specific odours actually trigger migraines.**

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

4. What five tastes have specific receptors?

5. Which parts of the brain are involved in sensing and perceiving odours?

6. What are supertasters?

7. How are smell and taste involved with migraines and epileptic seizures?

What Do You Think? • This section of the chapter listed some ways for people with

anosmia to compensate for their lack of smell, such as using smoke detectors. What other ways can you suggest that people with anosmia might use to replace the safety and pleasures that a sense of smell provides?

The Tactile or Cutaneous Senses: Touch, Pressure, Pain, Vibration

LEARNING OBJECTIVE 3

Describe how the different senses of touch work and what can happen when things go wrong.

Tactile, as we mentioned earlier, means "touch." As with the chemical senses, there are rewarding and aversive types of tactile stimuli. The pleasure associated with a relaxing back massage or stroking a baby's cheek stands in stark contrast to the discomfort of getting a scrape or burn. The tactile or somatosensory system is actually a complex sense. As shown in **Figure 5.6**, our skin contains a variety of sensory receptors to register different types of physical stimuli (Schiff & Foulke, 2010).

Free nerve endings are located mostly near the surface of the skin and function to detect touch, pressure, pain, and temperature.

> **free nerve endings** sensory receptors that convert physical stimuli into touch, pressure, or pain impulses.

Meissner's corpuscles transduce information about sensitive touch and are found in the hairless regions of the body, such as the fingertips, lips, and palms.

> **Meissner's corpuscles** sensory receptors that convert physical stimuli about sensory touch on the fingertips, lips, and palms.

Merkel's discs transduce information about light to moderate pressure on the skin.

> **Merkel's discs** sensory receptors that convert information about light to moderate pressure on the skin.

Ruffini's end-organs are located deep in the skin. They register heavy pressure and movement of the joints.

> **Ruffini's end-organs** sensory receptors that respond to heavy pressure and joint movement.

Pacinian corpuscles are also buried deep in the skin and respond to vibrations and heavy pressure.

Pacinian corpuscles sensory receptors that respond to vibrations and heavy pressure.

Pressure on the skin activates free nerve endings that give us the sense of being touched. As you may have noticed, your skin is not equally sensitive to tactile stimuli over your whole body. Certain parts of your body, for example, the skin on your elbow, are much less sensitive to touch than other areas, such as your face and hands. These differences likely arise as a result of different densities of free nerve endings. Areas that are more sensitive have more free nerve endings.

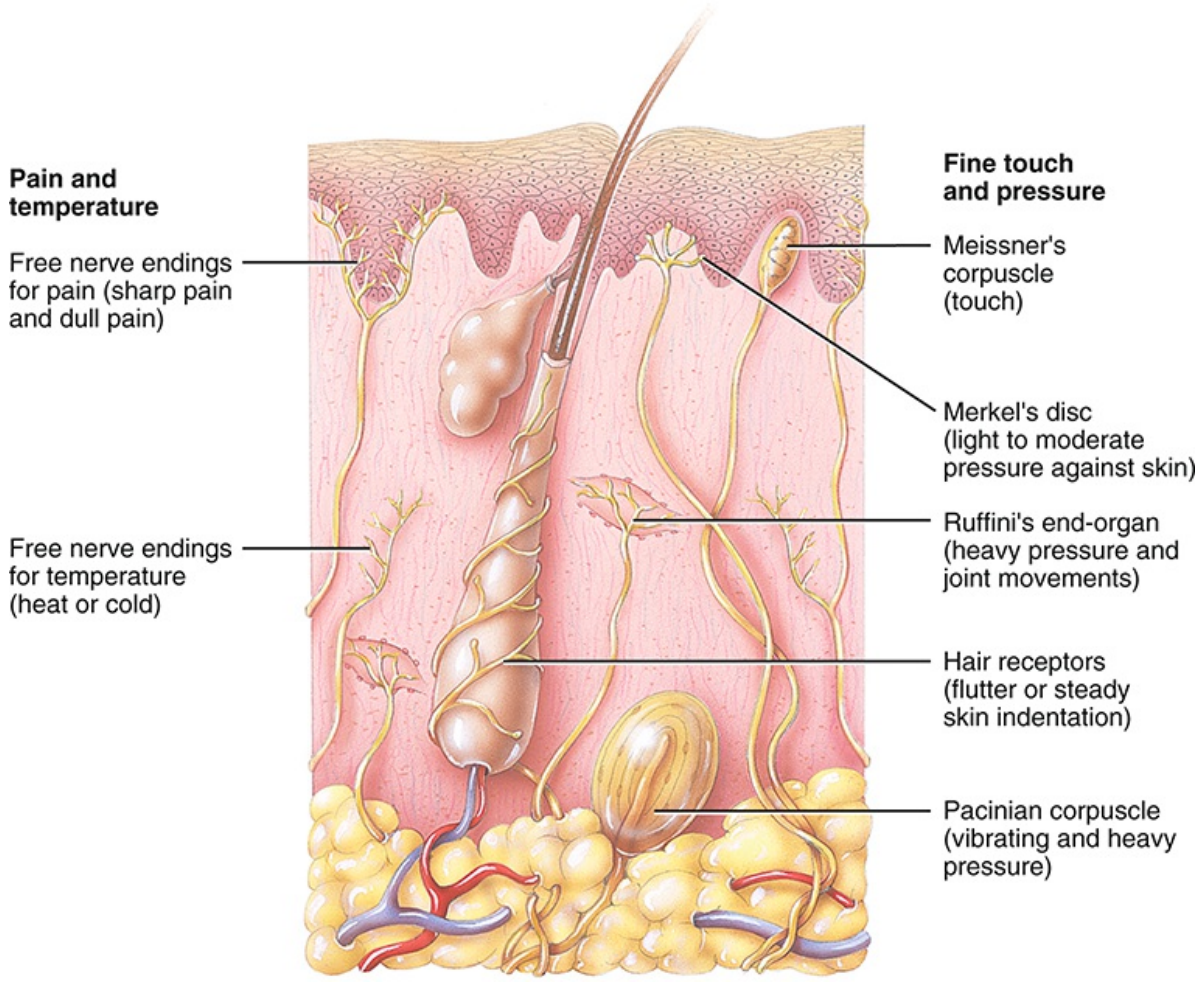


FIGURE 5.6 Sensory receptors in the skin The tactile senses rely on a variety of receptors located in different parts of the skin.

We can also experience sensory adaptation, resulting in reduced tactile sensation from depression of the skin that continues for a period of time. This happens to you every day when you put on your clothing; shortly after getting dressed, you are no longer aware of the tactile stimulus your clothing provides (unless, of course, something is too tight).

Tactile Senses and the Brain

Our brains use a variety of related processes to help us perceive general information about a range of non-painful touch sensations, including pressure, temperature, and general touch. Pain perception is also an important function.

The Touching Brain

When we touch something, or something touches us, our free nerve endings send tactile information into the spinal cord. The signals travel up the spinal cord to the brain, as shown in **Figure 5.7**. In the brain, touch information is first received in the thalamus, and then routed from there to the somatosensory cortex (located in the parietal lobe). Information about pressure and vibration is generally transmitted to the brain in a similar way, after being converted to neural impulses by the specialized receptors described above.

Our brain processes tactile information *contralaterally*, or on the opposite side of the brain from the side of the body where the touch occurred. So, if you touch something with your left hand, the information is processed by the somatosensory cortex on the right side of your brain.

As we discussed in Chapter 3, the somatosensory cortex does not have an equal representation of all parts of the body (Mather, 2016). For example, tactile inputs from the hands take up proportionately more space in the somatosensory cortex than those from the back. This seems reasonable, given the fact that our hands are specialized for object manipulation, and we need to process information from them in great detail. Information about pressure and vibration is generally transmitted to the brain in a similar way after being converted to neural impulses by the specialized receptors described above.

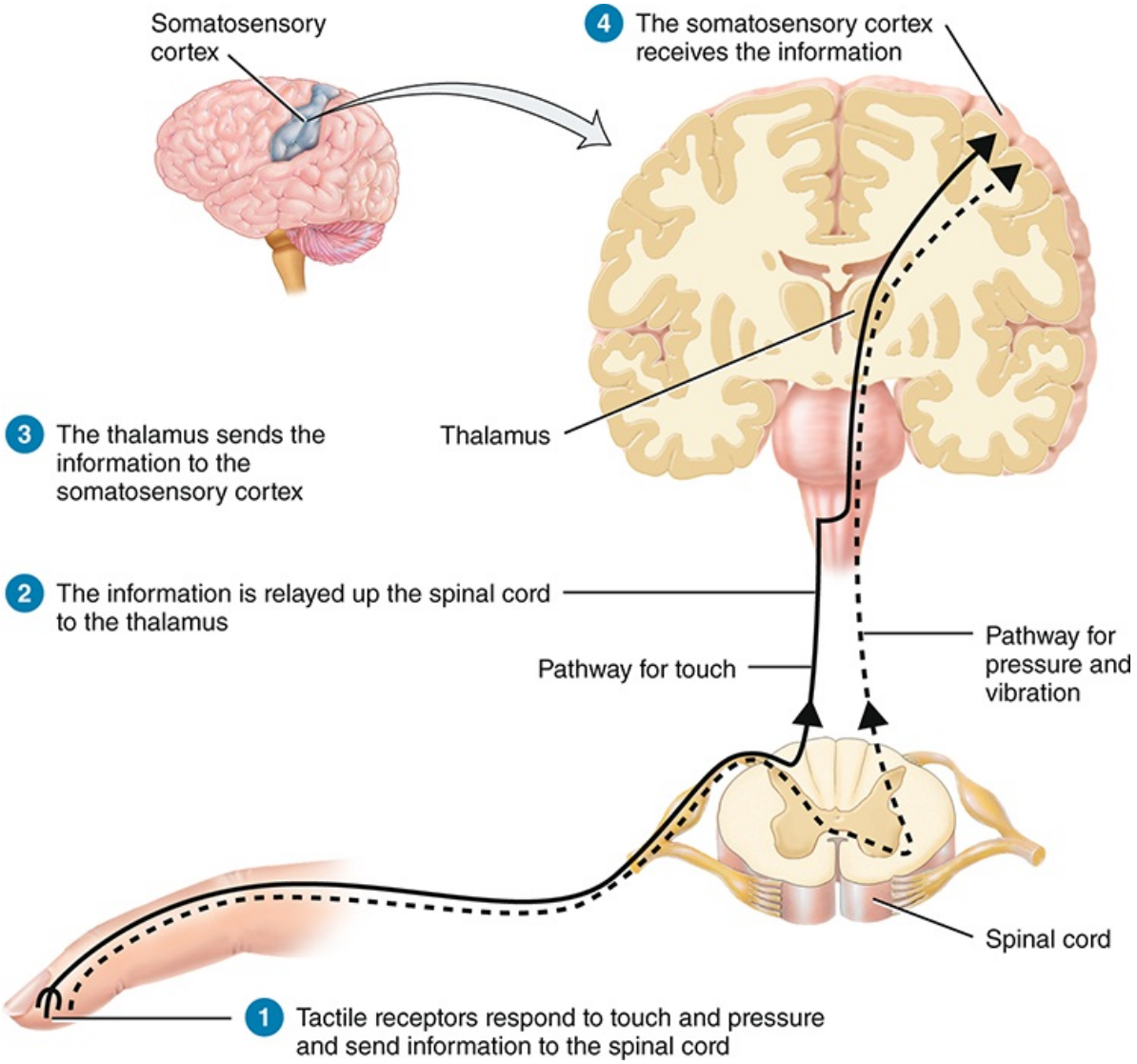


FIGURE 5.7 Somatosensory pathways in the central nervous system

Beyond these sorts of sensory reactions, we can extend our senses mechanically. The Canadian Space Agency, which developed the Canadarm used to manipulate cargo on the space shuttle, has been working with NASA on the development of virtual environment generating headgear called the Canadian Space Vision System. This technology will allow operators to "see" what the next generation of remote manipulator arms can see. Using this equipment will allow astronauts to literally "walk" the manipulators hand over hand along the outside of the international space station, and then perform manipulation tasks that the operator can see and control while they remain safe inside the ship (Guenther, Lovell, & Suaning, 2012).

Pain and the Brain

Like general touch information, painful sensations are also transmitted to the brain via free nerve endings (see photo). Pain information travels to the brain via two different types of pain fibres. One system, called the *fast pathway*, uses myelinated axons that, as we

discussed in Chapter 3, carry signals faster than unmyelinated axons. Messages about sharp, localized pain travel along the fast pathway directly up the spinal cord to the thalamus and to areas of the somatosensory cortex. Pain information received via the fast pathway helps us to respond quickly with a withdrawal reflex, such as pulling a hand away after touching a hot stove. The slower pain pathway uses more unmyelinated axons—these inputs communicate with brain regions involved in processing emotions. Pain we perceive via the slow pathway is more often burning pain than sharp pain (Prescott, Ma, & De Koninck, 2014).

Jostein Hauge/123 RF

Ouch! The fast pathway helps us to quickly respond to acute pain.

Like all other sensory systems we have discussed so far, the pain system shows evidence of sensory adaptation. A common example of this can be experienced when eating a spicy meal. Recall that the sensation of eating chili peppers is mostly due to the activation of pain fibres located on the tongue. Oftentimes, when a very spicy food is first ingested, the pain response seems great. However, as the meal progresses, the response diminishes and we are less likely to experience discomfort. This is due to adaptation of the pain fibres and a subsequent decrease in their activity. However, when pain is associated with actual tissue damage or an abnormality in the pain system, as discussed below, pain can be persistent and debilitating.

The Development of Tactile Senses

Like smell and taste, the tactile senses are generally in place at birth. In fact, studies have shown that fetuses can respond to even the touch of a hair at a relatively early stage in prenatal development (Lagercrantz & Padilla, 2016). As well, the pioneering work of Harry Harlow (see Chapter 4) indicated that physical contact is required for healthy development in infancy (Harlow, 1958). After birth, the ability to recognize and respond to different somatosensory stimuli is dependent on further brain development as well as learning.

For some children, one of the more enjoyable types of somatosensory input is being tickled (see photo). Although rough or prolonged tickling can become abusive, when tickled under

the right circumstances, children often explode with laughter. The reaction children have to tickling is a result of activation of somatosensory pathways in an uneven, uncontrollable, and unexpected manner. Not only are our sensory systems organized to detect change, but they are most tuned to stimuli that are unexpected and surprising. When you move your body and produce tactile sensations, these stimuli are less noticeable to you than are sensations produced by another individual. The sensations of your own legs touching one another when you cross your legs, for example, is generally less noticeable than a similar touch on your leg would be if someone sitting next to you brushed their leg against yours.

perkmeup/Getty Images

Somatosensory input **Tickling activates somatosensory pathways.**

Likewise, your reaction to your cat jumping onto your lap is likely to be much greater if you have your eyes closed when it happens. This differential response to surprising tactile stimuli appears to be a defence mechanism that has adaptive significance. It is probably also the reason why being tickled by someone else is more effective at producing an emotional reaction than trying to tickle yourself. Our enjoyment of being tickled generally diminishes as we age. This is likely due to the fact that adults are better at anticipating stimuli, and hence are more difficult to surprise, than are children. It may also reflect a change in tactile thresholds (becoming less sensitive to touch) with age.

Tactile Senses: Individual Differences

Humans differ greatly in their ability to detect physical stimuli on the skin. In addition, they

differ in the degree to which they find certain tactile stimulation pleasurable or aversive. For example, some people enjoy an intense back massage, while others do not. Of all the somatosensory experiences, the one that has received the most research attention is that of pain. Pain management for surgical procedures and other medical conditions is a critical part of patient care. There are dramatic differences in both the threshold to detect pain and the degree to which pain causes emotional suffering.

PixelsEffect/Getty Images

Lower pain threshold? Studies suggest that women have more pain receptors in their facial skin.

Although learning plays some role, people also differ in the actual sensation and perception of pain as a result of physical differences in their sensory systems (see photo). Studies have shown, for example, that women have a lower threshold for detecting pain than do men. They report greater pain intensity than men in response to the same stimulus (Petrini, Matthiesen, & Arendt-Nielsen, 2015). One interpretation of this sex difference is that women are just less able to cope psychologically with painful stimuli since they haven't been "toughened up." In fact, research suggests that women may have about twice as many pain receptors in their facial skin than men (Bartley & Fillingim, 2013). This suggests a physical cause for at least some of the differences in pain sensitivity. Another possible interpretation addressed by researchers is that gender role stereotypes may play a role in reporting pain intensity, with men less willing to admit when they do feel pain (Berke, Reidy, Miller, & Zeichner, 2017).

Neuroimaging studies show that people's brains react differently depending on their sensitivity to pain (Apkarian, 2013). People exposed to a high temperature stimulus in one study exhibited varied responses. Those who reported feeling pain showed changes in activity in their thalamus, somatosensory cortex, and cingulate cortex areas. Those who did not report feeling pain showed similar activity in the thalamus, but no changes in the cortical regions. Although there may be differences in the two groups' sensory receptors in their skin, these findings suggest that differences in activation of brain circuitry may also underlie varied responses to painful stimuli.

One classic theory, the **gate control theory of pain** by Canadians Ronald Melzack and Patrick Wall (1982), attempts to explain the relationship of brain activity to pain by suggesting that some patterns of neural activity can actually create a "gate" that prevents messages from reaching parts of the brain where they are perceived as pain. So for example, we can rub a shin we have knocked into something and dull the pain (Katz & Rosenbloom, 2015).

> **gate control theory of pain** theory that certain patterns of neural activity can close a "gate" to keep pain information from travelling to parts of the brain where it is perceived.

Early versions of this theory hypothesized that pain signals were blocked in the spinal cord, but later research has focused on neurochemicals or patterns of activity in the brain. Individual differences in gating mechanisms may result in the wide range of pain sensitivity across people (Moayedi & Davis, 2013).

Disorders of the Tactile Senses

As we have seen, sensing and perceiving pain are normal, and important, functions of our tactile senses. Some people, however, experience either too much pain or too little. Sometimes people even feel pain and other sensations in limbs or other body parts that have actually been removed.

Chronic Pain

The most common abnormality associated with the somatosensory system is that of chronic pain, or pain that lasts longer than three months. A relatively large percentage of North Americans, with estimates ranging from one in six to one in three, report suffering from chronic pain (Institute of Medicine, 2011). There are multiple causes of chronic pain, although in some cases the cause cannot be identified. In all cases, however, pain management is a critical issue, since prolonged pain sensations can interfere with daily functioning and may lead to depression or even suicide. One study indicated that 50 percent of Canadians living with chronic pain have severe levels of depression, with 34.6 percent reporting that they were thinking about suicide (Choinière et al., 2010). Recent research suggests that hope and strength-based approaches can help participants with chronic pain to feel more hopeful (see Positive Psychology 5.1)

5.1 Psychology Around Us | Positive Psychology

Chronic Pain and the Value of Hope

Denise Larsen, Rachel King, and Rachel Stege from the University of Alberta and Natasha Egeli from Liverpool John Moores University in England (2015) employed a hope and strengths-focused activity to examine the impact of hope with chronic pain patients. The significant negative impact of chronic pain has been clearly documented. Chronic pain impacts every life domain, including work, interpersonal relationships, recreation, and self-care, and is associated with increased substance use and abuse, increased depression and anxiety, and high rates of suicide (Charles, Carayannopoulos,

& Pathak, 2019; Dahlhamer et al., 2018; Hogan et al., 2016).

Research suggests that hope and other positive emotions disrupt cycles of recurring pain and emotional negativity (Katsimigos, O'Beirne, & Harmon, 2020; Larsen, Stege, King, & Egeli, 2018; Larsen & Stege, 2012). Strength-focused interventions have also been demonstrated to be clinically effective (Marmé, 2017). The purpose of Larsen et al.'s study was to determine whether client emotional wellness could be enhanced through a targeted hope and strength-based intervention. A session from the Being Hopeful in the Face of Chronic Pain Group, aimed at improving quality of life and well-being by focusing on existing strengths, was utilized.

Twelve male and female participants (from their 20s to their 70s), with 5 to 57 years of chronic pain resulting from a variety of pain conditions, participated in the study. In the session, participants drew a card from a hope and strength activity card set (Edey, King, Larsen, & Stege, 2016). Cards focused on strengths, such as courage, curiosity, or patience, were placed face up. Each participant first chose a card with a strength they felt they had and shared a story or description with the group explaining how they demonstrated that strength. Next, each participant selected a card representing a strength they hoped to have more of and again shared stories and descriptions with the group. Two to three days after the session, each participant was interviewed and invited to reflect on their expressed and unexpressed feelings from the session.

Results suggested that participants found connections to hope from the group therapy exercise. Four primary themes were identified from the interviews. Participants reported that they:

developed a new awareness of their strengths,

compared themselves with others and felt more capable and content,

felt a sense of support and shared community and therefore felt less isolated, and

felt a sense of universality, shared hope, and connection with others.

The results of Larsen et al.'s hope and strength-based approach helped participants with chronic pain to feel more hopeful and less alone. Participants developed a sense of understanding and communion with the broader population of chronic pain patients and perceived their lives as more meaningful as they identified their strengths and abilities.

Larsen et al.'s research underscores the emphasis in positive psychology of centring on what makes life most worth living by helping people to flourish through a focus on resilience and learned optimism (Seligman & Csikszentmihalyi, 2000). For further information, see the international publicly available database Hope-Lit at www.ualberta.ca/HOPE/.

Researchers have identified two groups of chemicals naturally produced by our nervous systems that have pain-relieving properties: **endorphins** and **enkephalins**. Endorphins and enkephalins belong to a class of molecules called *opiates*. As we will see in Chapter 6, this class of chemicals also includes pain-killing drugs, such as morphine, heroin, and oxycodone. When opiates are naturally present in the nervous system, they are referred to

as *endogenous opiates*. These molecules are released by neurons after intense physical exercise, stress, and sexual experience. They are also thought to be responsible for the ability of some people to perform heroic physical actions under extreme duress (Bodnar, 2017).

> **endorphins** and **enkephalins** chemicals that belong to a naturally occurring class of opiates that reduce pain in the nervous system.

Medical practitioners use opiate drugs that mimic or stimulate the endogenous opiate system for pain relief. However, people easily become addicted to opiate drugs. Opiate drugs are not only addictive when they are abused illegally, such as with heroin, but they are also addictive when they are prescribed medically, as happens with morphine, and more recently, oxycodone (OxyContin) and Fentanyl. Repeated use of these drugs to treat chronic pain can produce a physiological dependence that is very difficult to overcome. In addition, these drugs become less effective with continual use, so higher and higher doses are needed to achieve pain relief. The need for high doses can be lethal, however, as opiates suppress breathing. Eventually, people with chronic pain can reach a point where the dose of medicine needed to reduce their pain would be enough to stop their breathing and kill them, but lower doses do not provide them with pain relief (see Indigenous Experiences 5.1).

5.1 Indigenous Experiences

Chronic Illness and Pain

Pain can be defined as localized or generalized physical suffering or discomfort associated with actual or potential tissue damage and conveyed to the brain by sensory neurons. Pain can be either chronic or acute but chronic pain is not always due to a simple or direct cause and is often accompanied by psychological, emotional, and social distress (Mittinty, McNeil, & Jamieson, 2018).

Indigenous people suffer disproportionally from chronic pain. Low socioeconomic status and reduced access to pain management increases the risk of living with chronic pain in Indigenous communities (Julien, Lacasse, Labra, & Asselin, 2018). Increased pain leads in turn to physical and emotional suffering, depression, and social isolation. In spite of this, and in spite of the fact that pain management is viewed as a fundamental right (International Pain Summit of the International Association for the Study of Pain, 2011), chronic pain is often ignored as a health concern in Indigenous populations (Julien, Lacasse, Labra, & Asselin, 2018).

Moreover, cultures and belief systems play a significant role in how individuals experience pain. For example, because Indigenous persons can be ignored when they seek health care, they may come to expect this treatment and will therefore often wait until a condition is chronic. At that point they are often directed to an emergency room, ill equipped to handle chronic illness (Johnston, 2020).

For example, Amelia Boissoneau went to a clinic, very ill and in pain. The receptionist would not allow her to see a physician and was told she only had the flu. She says that

days later, as her pain intensified, “I ended up developing a horrible ear infection that was so painful it had me bedridden. My hearing was so sensitive [that] any sound hurt my ears. This all happened because the receptionist wouldn’t let me see the doctor when I knew they had no patients at the moment” (quoted in Chia, 2020).

Photograph: Blair Gable/Reuters

Chronic pain and systemic racism A residential school survivor reacts during the closing ceremony for the Truth and Reconciliation Commission of Canada.

Further, stereotypes that Indigenous people overuse opioids and other pain medications can affect how clinicians view Indigenous reports of pain. One New Brunswick physician posted a prominent sign in his office indicating that “Native” patients were not to ask for pain medications (Ku’Kuwes News, 2017, as cited by Johnston, 2020). This type of stereotyping implies that Indigenous people are physically more susceptible to opioid addiction, which is not true. Instead, higher rates of opioid addiction, chronic illness, and pain in Indigenous populations is largely attributable to systemic racism and the effects of colonialism, residential schools, displaced communities, and the loss of culture, language, land, and identity (Nutton & Fast, 2015).

Critical Thinking Questions

Why do you think that chronic pain is ignored by professionals when examining Indigenous people?

How would the stereotype of Indigenous people abusing opiods and other pain medications affect both short and long-term pain managment strategies? What long term effect might such a medical perception have on a person? Why?

Acute Pain

Medical practitioners are constantly seeking ways to provide relief to patients in chronic, or continuing, pain. But what about acute pain, such as the short-term pain you feel when

you burn yourself or you bump your leg on a table?

As discussed earlier, gate control theory suggests that touch sensations, which frequently travel along fast fibres, can help prevent some pain sensations travelling on the slow pathways from reaching areas of the brain where they are perceived. According to this theory, the brain only processes so much input, so touch can help to set up a "gate" that stops pain (Katz & Rosenbloom, 2015). This explains why we have a tendency to rub the skin of areas of our body that have been injured. For example, if you walk into a piece of furniture, you might rub your leg to dampen the pain.

No Pain

Some people are incapable of detecting painful stimuli. While the idea of feeling no pain may sound appealing at first, the fact is that our ability to recognize and respond to discomfort is critical for preventing physical damage to the body. Consider how often you shift position in your chair when you are studying or sitting in a lecture. If you were unable to receive signals of discomfort from your body, you would not move to relieve pressure on your skin. The parts of your skin under continuous pressure would develop sores or bruises. Since many everyday experiences would be damaging to our bodies if we were not able to detect discomfort, a lack of ability to detect pain can be very dangerous.

Some people are born unable to feel pain. A rare genetic condition called *familial dysautonomia* is associated with an inability to detect pain or temperature, as well as the inability to produce tears (Norcliffe-Kaufmann, Slaugenhaupt, & Kaufmann, 2016). Children with this disorder are at grave risk of life-threatening injuries and must be monitored very carefully (see photo). Loss of pain sensation can also be acquired later in life. Some medical conditions, including diabetes, can cause *neuropathies*, or nerve dysfunctions, that block pain sensations arising from the person's extremities (Deli et al., 2014). People with such neuropathies may not notice if they sustain an injury in an affected area, such as a toe. Sometimes tissue can get so damaged that it must be amputated.

AP Images/Jim Mone

She feels no pain **The child on the right looks like any other 3-year-old welcoming her big sister home from school, except for the goggles she is wearing. The child, who suffers from a severe case of familial dysautonomia, cannot detect any pain to her body and must wear goggles to protect her eyes from excessive rubbing and scratching. By age 3 she has lost one eye, damaged the other, and inadvertently chewed apart portions of her tongue and mouth and therefore had to have all of her teeth removed.**

Phantom Limb Sensations and Pain

Many individuals with amputated limbs report tactile non-painful hallucinations or *phantom* sensations of neuropathic pain, including touch, pressure, vibration, pins and needles, heat, cold, and pain in the body part that no longer exists. Some people may even continue to feel the sensation of a ring on the finger or a watch on the wrist of an amputated arm. Others, with phantom limb pain, report feeling as if their phantom limb is tightly curled up and very painful. Similar phantom experiences have been reported in women who have undergone a mastectomy for the treatment of breast cancer, with some reporting a phantom breast phenomenon that caused pain and suffering (Björkman Lund, Arner, & Hyden, 2017).

Researchers believe that such phantom sensations are the result of abnormal activity in the

somatosensory cortex of the brain. When a body part is removed, the part of somatosensory cortex that previously received its input does not become inactive (Flor, Diers, & Andoh, 2013). Instead, somatosensory inputs from intact body parts expand to occupy those regions of the cortex (Ramachandran & Brang, 2016). Since information from the face is represented in an area of the somatosensory cortex located near that of the arm and hand, a person whose arm was amputated is likely to experience an expansion of the somatosensory inputs from her face into the arm and hand regions of cortex. So when, for example, someone touches her cheek it is as if the missing hand is being touched. The body then interprets the message that something is not right as pain.

Although researchers do not fully understand how reorganization of the somatosensory cortex produces phantom sensations, there is clearly a memory component to the phenomenon. People are more likely to experience phantom sensations that they actually felt previously, as opposed to random sensations. For example, someone who previously wore a ring or a watch is more likely to have the sense of wearing one after an amputation than is a person who didn't wear a watch or ring. Similarly, people who previously experienced considerable pain in their now-missing body part are much more likely to feel phantom pain. There are some amazing case studies involving phantom body parts. For example, a woman born with only stumps of arms can still sense her "hands" and reports gesturing with them when she talks. Children who have lost a hand say they still use their missing "fingers" to help them with counting (Makin et al., 2013).

Vilayanor Ramachandran developed "mirror box" therapy for amputees experiencing pain in a missing limb. The mirror box, as its name suggests, involves placing mirrors around the individual on the same side as their missing arm. To the participant it looks like their missing arm is back, though it is only the reflection of their remaining arm. Moving their intact limb creates the sensation of movement in their missing limb and, over time, can lessen the pain in the missing or phantom limb (Ramachandran & Brang, 2016; Foell, Bekratar-Bodman, Diers, & Flor, 2014).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

8. List the different types of tactile receptors in the skin and the primary functions of each.

9. Compare and contrast slow and fast pain pathways.

10. Why do children so often enjoy getting tickled?

11. What are some possible explanations for individual differences in pain sensitivity?

What Do You Think? • Have you experienced an occasion when your senses have worked together to either enhance or diminish pain or another touch sense? For example, did certain sights or sounds make pain better or worse?

The Auditory Sense: Hearing

LEARNING OBJECTIVE 4

Summarize what happens when we hear.

As we will see, vision is the major sense, with more of the cortex devoted to vision than any other sense (Schwartz, 2010). However, the auditory sense plays a crucial role in social communication, as well as in our ability to detect danger. In addition to these clearly adaptive roles, the ability to hear enriches our lives through music and other pleasurable sounds.

From Sound Waves to Sounds

The auditory system is designed to convert sound waves, vibrations of the air, into neural impulses. **Sound waves** have two major qualities that produce our perceptions of different sounds:

Frequency. The *frequency* of a sound wave refers to the number of cycles the wave completes in a certain amount of time. Frequency of a sound wave is measured in units called *Hertz* (Hz), which represent cycles per second. The frequency of a sound wave is responsible for producing the *pitch* of a sound. The crying of a baby is a high-frequency sound wave that produces a high-pitched sound. Although the range of human hearing is quite large, we hear sounds best within the range of 2,000–5,000 Hz, which encompasses the frequencies of most sounds that humans actually make, such as babies crying and people talking.

Amplitude. The *amplitude* of a sound wave refers to the strength of a given cycle. Waves with higher peaks and lower bottoms are of higher amplitude than those that do not reach such extremes. The amplitude of a sound wave is responsible for our detection of *loudness*. Waves with high amplitudes produce loud sounds, while those with low amplitudes sound soft. Loudness is measured in units called *decibels* (dB).

sound waves vibrations of the air in the frequency of hearing.

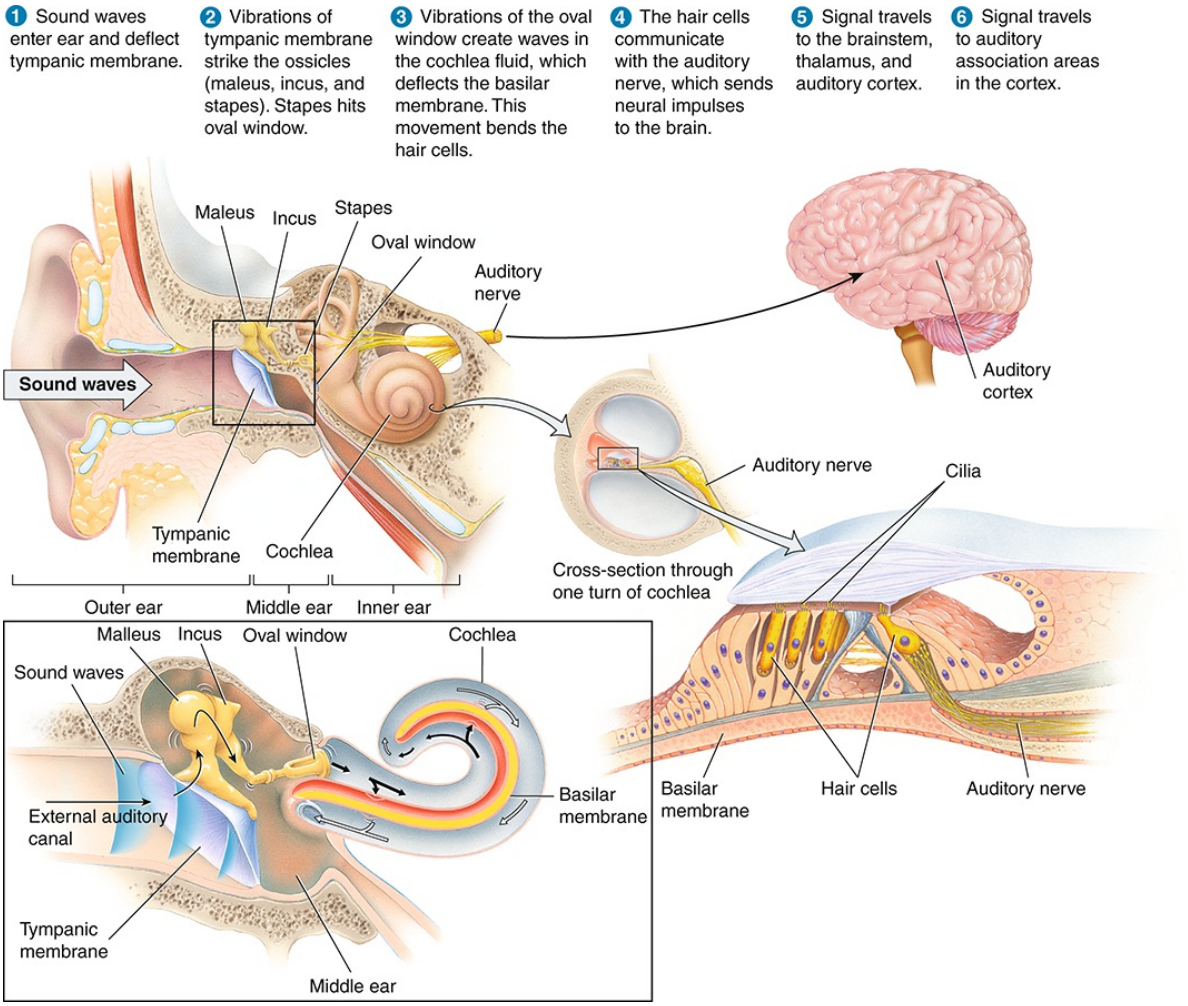


FIGURE 5.8 How the ear hears Inset box adapted with permission of John Wiley & Sons, Inc. from Tortora, G. & Nielsen, M. (2014). *Principles of Human Anatomy* (13e). Hoboken, NJ: Wiley, p. 693.

Our detection of sound begins, of course, in the ear. Sound waves are converted to neural impulses in the ear through several steps (Hackney, 2010), as shown in **Figure 5.8**.

First, sound waves enter the outer ear and at its deepest part, deflect the ear drum or **tympanic membrane**.

tympanic membrane the ear drum.

Vibrations of the tympanic membrane set in motion a series of three tiny bones or **ossicles**, called the maleus (*hammer*), incus (*anvil*), and stapes (*stirrup*). The stapes, which is the last bone in the chain, hits the **oval window**, a membrane separating the ossicles and the inner ear.

ossicles tiny bones in the ear called the maleus (*hammer*), incus (*anvil*), and stapes (*stirrup*).

oval window a membrane separating the ossicles and the inner ear, deflection of which causes a wave to form in the cochlea.

Deflection of the oval window causes a wave to form in the fluid-filled **cochlea** of the inner ear. When fluid moves in the cochlea, it deflects the **basilar membrane** that runs down the middle of the cochlea. The basilar membrane is covered with rows of hair cells, the auditory sensory receptors. Movement of the basilar membrane bends the **hair cells** that transduce the "fluid sound wave" into electrical activity (Hudspeth, 2014).

cochlea fluid-filled structure in the inner ear; contains the hair cells.

basilar membrane structure in the cochlea where the hair cells are located.

hair cells sensory receptors that convert sound waves into neural impulses.

The hair cells communicate with nerves in the cochlea that, in turn, send the neural impulses to the brain.

After auditory information is transduced from sound waves by the hair cells in the basilar membrane of the cochlea, it travels as signals from nerves in the cochlea to the brainstem, the thalamus, and then the auditory cortex, which is located in the temporal lobe.

Part of the primary auditory cortex is organized in a **tonotopic map**. That is, information transmitted from different parts of the cochlea (sound waves of different frequency, and therefore sounds of different pitch) is projected to specific parts of the auditory cortex, so that our cortex maps the different pitches of sounds we hear. Auditory information from one ear is sent to the auditory cortex areas on both sides of the brain. This enables us to integrate auditory information from both sides of the head and helps us to locate the sources of sounds.

tonotopic map representation in the auditory cortex of different sound frequencies.

From the primary auditory cortex, auditory information moves on to the auditory *association areas* in the cortex. As we described in Chapter 3, association areas of the brain's cortex are involved in higher-order mental processes. For example, association areas help to link the sounds we hear with parts of the brain involved in language comprehension.

Association areas also integrate or coordinate auditory information with signals from other sensory modalities. Have you ever noticed how distracting it is to watch a movie that has the audio slightly out of synchrony with the video image? This is because the brain is set up to integrate information from multiple sensory systems. Over time, we learn to have expectations about the coincidence of certain visual stimuli with specific sounds. When the sounds in a movie do not match the visual images the way they would in real life, our expectations are violated and our attention is drawn to this discrepancy from the norm.

Identifying Frequency and Pitch

There are two major theories about how the auditory system converts sound waves into all the various sounds we can perceive. The first, called *frequency theory*, suggests that different sound frequencies are converted into different rates of action potentials or firing in our auditory nerves. According to this theory, high-frequency sounds produce a more rapid firing than do low-frequency sounds. Although there may be some truth to frequency theory—different firing rates contribute to sound perception of low tones—researchers agree that this theory cannot fully explain sound perception.

The second theory, called *place theory*, seems to account for a greater degree of auditory perception. Place theory holds that differences in sound frequency activate different regions on the basilar membrane. Regions along the basilar membrane send inputs to the brain that are encoded according to the place along the membrane where the inputs originated. It may be that aspects of both theories are actually at work in processing frequency information, with low-frequency sounds translated through frequency coding and high-frequency tones signalled through pitch (Moore, 2010; Yost, 2010).

We differ greatly in our ability to detect specific sounds. People show particular differences in their ability to identify certain notes in a scale. **Absolute pitch** refers to the ability to recognize an individual note in isolation (see photo). This is very difficult for most people. Only about 1 in 10,000 people in Western countries has absolute pitch. This ability seems to originate in childhood between the ages of 3 and 6 years, through musical training. It is associated with differences in brain anatomy (Dohn et al., 2013). Although past research has shown that portions of the cortex are actually thinner in individuals with absolute pitch (Hou et al., 2016), it's not clear whether people with absolute pitch start out with a thinner cortex or whether they develop it through training. It's possible that synaptic pruning contributes to this structural difference.

> **absolute pitch** the ability to recognize or produce any note on a musical scale.

Studies have shown, however, that people who speak tonal languages, or languages in which differences in tone convey meaning, such as Vietnamese and Mandarin Chinese, are more likely to develop absolute pitch than those speaking Western languages. This again suggests the possibility that early learning of auditory information related to tones can have a permanent effect on the functioning of this sensory system (Deutsch, 2013). Robert Zatorre at the Montreal Neurological Institute argues against this cultural conclusion, pointing out that tonal languages rely on relative pitch rather than absolute pitch. Instead, he believes genetics plays a role (Trainor & Zatorre, 2015; Zatorre, 2003).

Gregg DeGuire/Getty Images

Absolute pitch **Singer Mariah Carey was born with absolute or perfect pitch—the ability to recognize or produce any note on a musical scale.**

5.2 Indigenous Experiences

Throat Singing

The Inuit believed that a song originated within the body, rather than the mouth, and that chanting, and singing were a way to communicate more effectively with the spirits. Singing was therefore believed to have healing abilities for both the singer and the listener (Bamarki, 2016).

Throat singing is a traditional form of singing for the Inuit that reinforces a sense of connection with history, community, and tradition. Throat singing is a guttural style of singing and chanting that uses circular breathing and resonant harmonies. Throat singing involves two people, usually women, who face one another and repeat sounds back and forth, alternating high versus low notes and pitches. The first person to lose breath loses the game. The sounds are made by the participants as they inhale and exhale, thereby creating a continuous sound (Remy, 2020). Traditionally, women entertained themselves with this vocal game while the men were out hunting and they also used throat singing as a way to soothe a fussy baby, who could feel the vibrations in its mother's throat.

Throat singing works by producing harmonies using biofeedback to produce two or more notes simultaneously. The singer controls how quickly the vocal cords are opening and closing, keeping them open for short periods and closed longer. Rapid closures create a clearer sound. Throat singers also move their jaws forward and purse their lips in order to influence the fundamental frequencies of the sound (Nattiez,

2016).

Historically, throat singing was forbidden by local priests as it was deemed shamanistic. Throat songs vary from one region to the next. Some are more word-based than others, although even Elders no longer know the meanings of the words (Remy, 2020).

Tawna Brown / Alamy Stock Photo

Harmonizing Sisters Karin and Kathy Kettler are Inuit throat singers, shown here at a music festival in Yellowknife, NWT.

Margaret Uyauperk Aniksak says, "The words contained in the throat singing tradition are words that were used by our remote ancestors. People have forgotten the meaning behind the words and that, I assume, adds to why people don't have any knowledge of their meaning … They came from the mouths of the ancients" (van den Scott, 2016, pg. 103).

Critical Thinking Questions

Do you think throat singing depends more on pitch or frequency?

Why do you think throat singing was considered shamanistic?

Do you think you could throat sing if you were tone deaf? Why or why not?

Just as some people exhibit absolute pitch, others are tone deaf, or unable to discern differences in pitch. Although tone deafness or *amusia* is sometimes the result of damage to the auditory system, it can be present from birth, and researchers believe it may be related to genetics (Zendel, Lagrois, Robitaille, & Peretz, 2015). Tone deafness affects up to 4 percent of the population and mostly results in a diminished appreciation for music. Although music appreciation is an important enriching ability, people with tone deafness are able to enjoy all other aspects of life. This condition only presents serious social problems when it occurs in cultures where the language is tonal (see Indigenous Experiences 5.2).

Drowning Out the Noise

As with the other sensory systems we have discussed, adaptation also occurs in the auditory system when we are continuously exposed to sounds. We can adapt to sounds in several ways. First, our ears respond to very loud sounds by contracting muscles around the ear's opening so that less of the sound wave can enter the ear. This also happens when we talk, so that the sound of our own voice, which is so close to our ear, is not deafening.

Second, the hair cells of the ear also become less sensitive to continuous noises. Unfortunately, if the noise is loud enough, it can actually damage the hair cells (Liberman & Kujawa, 2014). Unlike receptors for the chemical senses, our sensory receptors in the ear are not readily replaced, so damage to the hair cells makes the ear permanently less sensitive (see Psychology Around Us 5.2).

5.2 Psychology Around Us

Going, Going, Gone!

Have you ever left a loud concert or club or party with a ringing in your ears? You may have had a great evening, but you have probably done irreparable damage to your hearing. In fact, hearing loss among young people in Canada (Feder et al., 2015) is on the rise. Research by Robert Harrison at Toronto's Hospital for Sick Children indicates that Canadian teens listen to music that is dangerously loud (Harrison, 2012). According to one study, about one in five U.S. teens also has some hearing loss—an increase of about 30 percent over the previous 20 years or so (Shargorodsky, Curhan, Curhan, & Eavey, 2010). Frequent exposure to loud music—whether live or through earphones—is largely responsible for this loss of hearing. Portable listening devices such as smart phones can deliver music as loud as 100 decibels through headphones. And this is bad—very bad. Research by Jos Eggermont at the University of Calgary has shown that chronic exposure to sounds 85 decibels and above can be hazardous to your long-term auditory health (Eggermont, 2010). Although there is ample evidence suggesting that young people do not take their auditory health very seriously (Gilles, 2014), you need to be an exception. If you want to continue to enjoy music as you get older, you would do well to protect your hearing today. Noise-induced hearing loss is irreversible.

Finally, the brain can filter out many sounds that are not important, even if they are relatively loud (see photo). This ability enables you to carry on a conversation with your friends at a noisy party. This phenomenon, often referred to as the *cocktail party effect*, is another example of top-down processing. The brain is able to attend to, and pick up on, relevant sounds, even in a very noisy environment. These relevant sounds, such as your name or the names of people who interest you, grab your attention and focus your auditory perception because you have previously learned their importance. So background noise, even if it's also the sounds of people talking, interferes minimally with hearing a conversation, as long as the conversation is of interest to you.

Slonov/E+/Getty Images

What television? This teen seems oblivious to the loud sounds coming from the television. He is concentrating on his studying while filtering out the irrelevant TV noise.

Sounds in Space

To determine the importance of a particular sound, it's necessary to localize it in space, to figure out where it is coming from. For example, if you're driving in a car and you hear the sound of an ambulance siren, you need to determine whether the ambulance is far away or close up so you can decide whether or not to pull over to the side of the road to let the ambulance pass. You also need to determine from which direction the sound is approaching. The auditory system uses several cues to help localize sound:

General loudness We learn from many early experiences that loud sounds are usually closer to us than are quiet sounds, so that eventually we automatically use the loudness of a sound to assess the distance between ourselves and the source of the sound.

Loudness in each ear Because of the distance between our ears and the presence of the head between our ears, there are slight differences between each ear in the loudness of the same sound wave. The ear closer to the sound hears a louder noise than the ear farther from the sound. This difference is particularly useful in detecting the location of high-frequency sounds.

Timing Another cue used to localize sound is differences in the time at which sound waves hit each ear. Sound waves will reach the ear closer to the source of the sound before they reach the ear farther away. Since the ears are separated in space, a sound wave will also hit each ear at a slightly different part of its wave cycle, creating a phase difference. This cue is particularly useful to us in localizing sounds with low frequencies.

Andreas Bastian/Agencja Fotograficzna Caro/Alamy Stock Photo

Music therapy **The majority of children who are hearing impaired are able to experience vibrations, rhythms, and melodies when playing an instrument. Moreover, music therapy helps these children to acquire functional gains in other social and cognitive areas.**

We also adjust our heads and bodies to assess the location of sounds (see photo). These movements allow us to hear how the sound changes while we're in different positions and to use those changes to help make a reasonable approximation of its location. Finally, the use of other sensory systems, such as vision, may come into play. For instance, you might confirm the location of the ambulance when you look into your rearview mirror and see it approaching.

Development of Hearing

Our ears are formed and are capable of transducing sound waves before we are even born. In fact, human fetuses have been shown to respond to noises long before birth. Research has shown that fetuses respond to loud noises with a startle reflex, and that after birth, they are capable of recognizing some sounds they heard while in utero (see photo). Sound conduction is inefficient at birth, but the ability to recognize and respond appropriately to a wide variety of sound stimuli is acquired in the first few months (Rand & Lahav, 2014). Infants prefer speech sounds to non-speech sounds (Vouloumanos, 2010) and prefer their mother's voice to other voices. We describe language development in more detail in Chapter 9.

Sensitive periods exist for the development of both language and music learning (White, Hutka, Williams, & Moreno, 2013). As we described in Chapter 4, we acquire certain abilities during sensitive periods of development much more easily than we do after the sensitive period has ended. The tonotopic map in the primary auditory cortex of the brain is organized during such a sensitive period of development (Clause et al., 2014). Jos Eggermont, at the University of Calgary, has shown that experiments with animals indicate that exposing animals to pure tones during a certain time in development leads to a faster, permanent representation of those sounds in the auditory cortex compared with a slower response after the sensitive period in development is over (Eggermont, 2013). If a sound is

made important to the animal, however, by pairing it either with a reward, such as water, or a punishment, such as an electric shock, the primary auditory cortex can be reorganized so that more of it responds to the relevant tone (Wigestrand et al., 2017). Such top-down processing of tones indicates that this region of the brain still shows plasticity after the sensitive period is over. However, it is not as easy to remap the brain after a sensitive period as it is during one.

Africa Studio/Shutterstock.com

A bit too early **A pregnant woman tries to introduce music to her fetus by positioning headphones on her stomach. Although fetuses do indeed respond to loud noises and can detect certain sounds, the acquisition of musical skills cannot take place until sensitive periods unfold during the preschool years.**

Hearing Loss

There are approximately 3 million people in Canada and 466 million people in the world (6.1% of the world's population) suffering from hearing loss (WHO, 2020; Paul et al., 2019). Based on the above discussion of the auditory system, you might be able to predict the two major causes of deafness: conduction deafness and nerve deafness. *Conduction deafness* occurs when there is some sort of occlusion or break in the various processes by which sound is transmitted through the inner ear. Wax buildup, infection, ear drum damage, or water in the ear can cause temporary or permanent deafness. *Nerve deafness* results from damage or malformations of the auditory nerve in the brain (Sheffield & Smith, 2019). All congenital (from birth) incidents of deafness are of this second type.

There are many conditions that lead to abnormalities in the auditory system. Some cause either partial or total **deafness**, the loss of hearing. Some deafness occurs after a period of hearing, with 90 percent of those affected born with normal hearing (Islam, Sattar, & Ali, 2011). Others who are deaf have never heard sound. Deafness has a variety of causes. It can be genetic or caused by infection, physical trauma, or exposure to toxins, including overdose of common medications such as aspirin. Abnormalities in the auditory system can also add unwanted auditory perceptions.

deafness loss or lack of hearing.

Since speech is an important mode of communication for humans, deafness can have dramatic consequences for socialization. This is a particular concern for children, because young children need auditory stimulation to develop normal spoken language skills. For this reason, physicians try to identify auditory deficits at an early life stage. Auditory deficits range from those with limited hearing to those who are profoundly deaf. Many deaf individuals learn to use sign language. There are hundreds of sign languages worldwide. *American Sign Language (ASL)* is the predominant sign language used in the United States and in English-speaking Canada, whereas French Canadians use *Quebec Sign Language* or *Langue des signes québécoise (LSQ)*. Sign languages have their own vocabulary, phonology, and grammatical structure (Goldin-Meadow & Brentari, 2017).

Research has also made progress in the construction of cochlear implants that help individuals with deafness to hear sounds (Zeng & Fay, 2013). (See photo.) Although this work is developing at a rapid pace, there remain many deaf people who are not helped by cochlear implants, particularly adults who never learned to process sound as children (David et al., 2016). This is one reason why many individuals and families choose to avoid them. As well, some in the deaf community also believe that hearing is not necessary to lead a productive and fulfilling life. For them, the potential benefits of implants may not outweigh the potential risks of surgery required to place them in the cochlea (Anderson, 2013).

Anne Cusack/Getty Images

A world of new possibilities **After undergoing successful cochlear implant surgery, this young child will now be able to process speech and sound.**

Some individuals are troubled by annoying sounds rather than hearing loss. About 1 of every 200 people is affected by *tinnitus*, or ringing in the ear. Tinnitus has multiple causes, some of which are related to abnormalities in the ear and some to structural changes in the brain (Simonetti & Oiticica, 2015; Langguth, Kreuzer, Kleinjung, & De Ridder, 2013). Some people are able to cope with the noise, but some find it too loud and distracting to ignore.

Patients with epilepsy in the temporal cortex have reported the perception of hearing complex auditory stimuli, such as a musical tune (Vreeburg, Leijten, & Sommer, 2016). This symptom, which can be completely distracting and disturbing to the patient, is the result of abnormal electrical activity in brain circuits that store complex auditory memories.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

12. What happens in the ear to transduce sound waves into neural signals?

13. What is a tonotopic map?

14. What are sensitive periods and how are they important for hearing?

15. What is tinnitus?

What Do You Think? • How might researchers develop an effective program that would get adolescents and young people to be more aware of and cautious about chronic exposure to loud music?

The Visual Sense: Sight

LEARNING OBJECTIVE 5

Describe key processes in visual sensation and perception.

The ability to see and make sense of the visual world around us plays a very important role in human life. We use vision in virtually all of our activities. Vision is especially important for non-verbal communication, where facial expressions and body language are used to convey information that is often lost in spoken language alone. Have you ever experienced a misunderstanding over text or email because, without non-verbal facial and body cues accompanying your message, the receiver misunderstood what you were trying to say? No doubt related to its importance to us, the visual sense is particularly well-developed in humans.

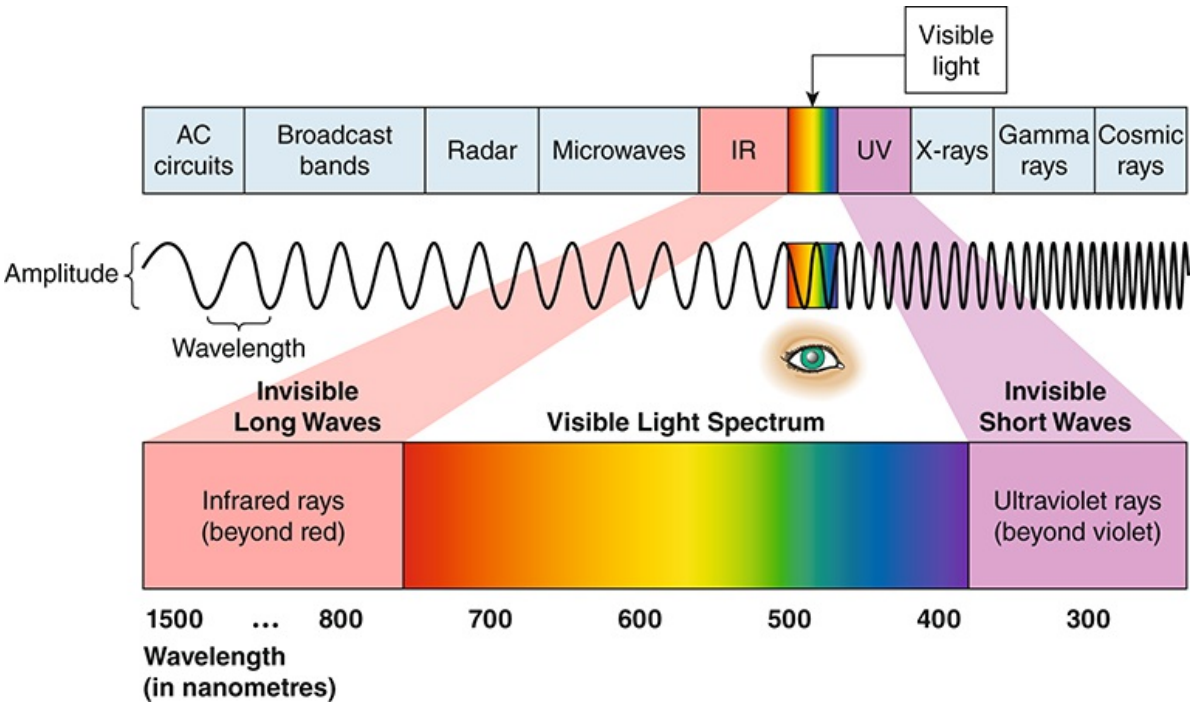


FIGURE 5.9 Visible light and the electromagnetic spectrum The part of the electromagnetic spectrum that our visual receptors can detect is restricted to a narrow range. Source: Reprinted with permission of John Wiley & Sons, Inc. from Huffman, K. (2009). *Psychology in Action* (9e). Hoboken, NJ: Wiley, Figure 4.4, p. 138.

As we have seen, each sensory system is most receptive to some form of physical energy. Taste and smell respond to chemical stimuli, touch to changes in temperature or pressure, and hearing to vibrating air molecules (sound waves). The stimulus for vision is electromagnetic radiation, which produces light. Light is made up of particles called *photons*. The light that we can see is part of the electromagnetic spectrum of energy that also includes many forms we cannot see, such as X-rays and radio waves. Like sound, light travels in waves. The visible spectrum of light ranges from about 400 to 700 nanometres in wavelength (a nanometre is a billionth of a metre). As shown in Figure 5.9, different wavelengths within our visible spectrum appear to us as different colours. Objects in the world absorb and reflect light in varying levels and patterns—those that reflect more light are perceived as brighter.

Seeing the Lights

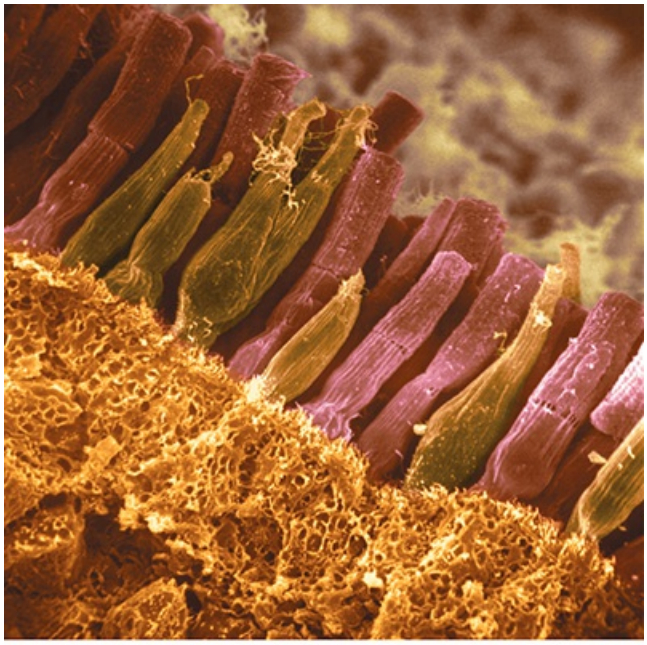
Vision begins when light enters the eye, as shown in Figure 5.10. Muscles in the iris—the coloured part of the eye—adjust the size of our pupils to let in more or less of the light reflected from objects around us. Muscles also adjust the shape of the lens, enabling it to bring both near and far objects into focus. The lens therefore serves to focus the light that enters the eye onto a specialized multi-layered sheet of nerve cells in the back of the eye, called the **retina**. If the lens of the eye cannot quite manage the task of focusing light, it can be assisted by glasses or contact lenses, or it can sometimes be reshaped by laser surgery so that it can do its job of focusing light onto the retina. The retina is an extension of the

brain and is where light produces chemical changes that in turn produce a neural signal.

> **retina** a specialized sheet of nerve cells in the back of the eye containing the sensory receptors for vision.

This process of converting light waves into neural impulses that the brain can process is known as **transduction** (see photo).

> **transduction** process that involves converting stimulus energy into neural impulses that can be interpreted by the brain.



Omikron/Science Source

The photoreceptors This colourized scanning electron micrograph shows the retina's photoreceptors—the rods and cones—which help pass visual signals through the optic nerve to the brain. Rods (pink) are the photoreceptors that detect light. Cones (olive) are photoreceptors that detect wavelength, creating the perception of colour.

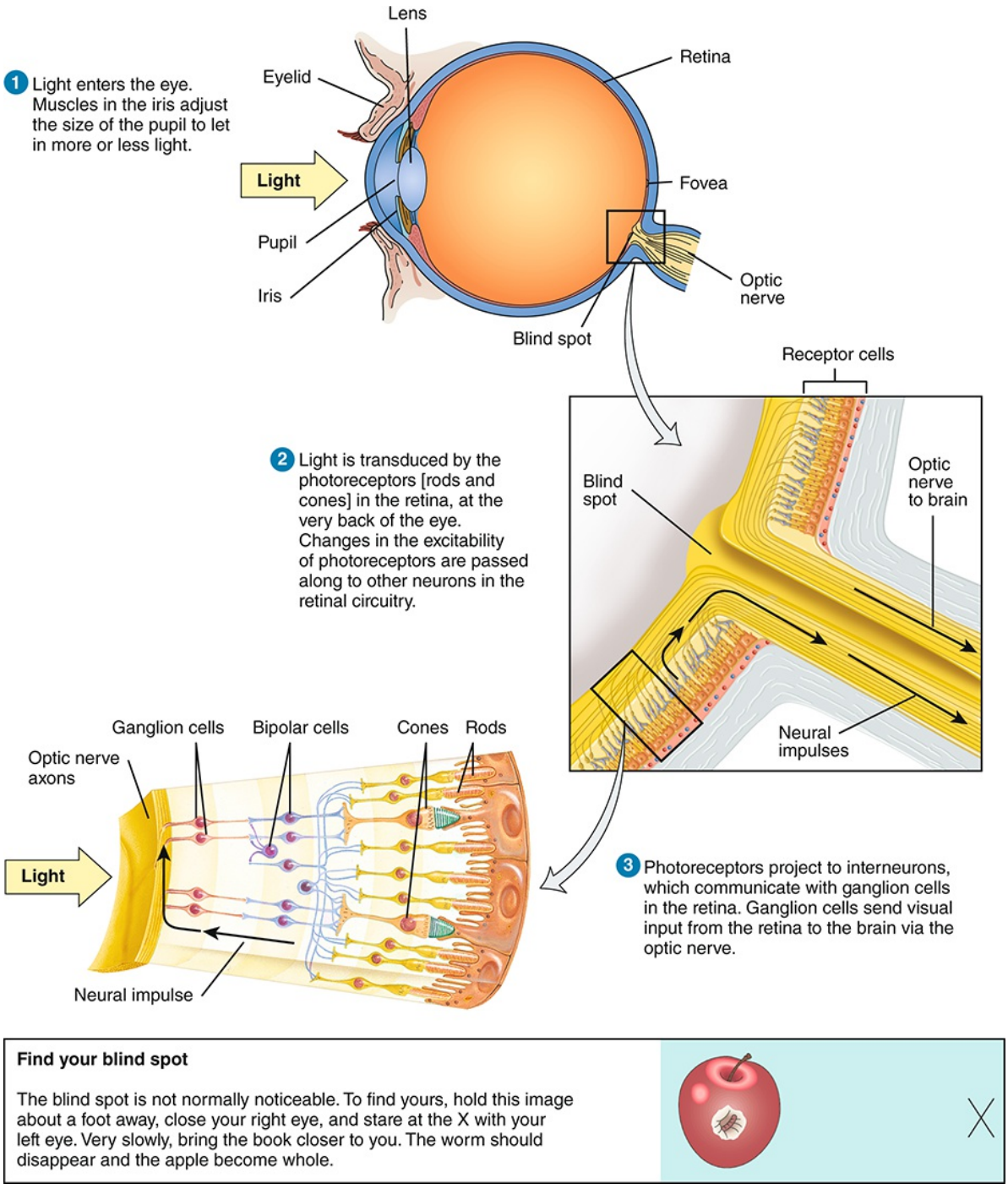


FIGURE 5.10 How the eye sees

Two major classes of visual receptors or **photoreceptors** exist in the retina, the **rods** and the **cones**. The rods predominate. There are over 100 million rods in the human retina. Rods are important for detecting light; they are highly sensitive to small amounts of light and are critical for functioning in dim light or at night. Rods give the perceiver no colour sensation. Cones, on the other hand, are colour receptors because they respond to light of different wavelengths. The cones are much fewer in number, with only about 4.5 to 6

million per human retina (Curcio, Sloan, Kalina, & Hendrikson, 1990). People have to function both during the day and the night, and so they have both rods and cones. Animals that primarily function in only the day or the night have either one set of receptors or the other. For example, nocturnal birds and animals such as owls have retinas composed entirely of rods, allowing them to survive in very low light conditions. Conversely, diurnal birds and animals such as the pigeon or chipmunk have only cones in the retina, allowing them to function effectively in a richly-coloured environment under optimal light conditions (Cronin, Johnsen, Marshall, & Warrant, 2014).

photoreceptors the sensory receptor cells for vision, located in the retina.

rods photoreceptors most responsive to levels of light and dark.

cones photoreceptors responsive to colours.

When light reaches the photoreceptors, a series of chemical reactions take place. The rods and cones stimulate the bipolar cells that, in turn, cause ganglion cells to then fire. The axons of almost one million ganglion cells are bundled together to form the **optic nerve**. Signals from the ganglion cells travel along the optic nerve out of the eye and into the brain. The location where the optic nerve leaves the retina is therefore completely lacking in rods and cones and is called the *blind spot*, or *optic disc*. This means that when light strikes that area of the retina, there are no visual receptor cells to respond to it. Although there are no receptor cells in this area, you do not experience a "hole" in the visual field because the brain fills in the incomplete image. Also, the blind spot in each eye is offset, so that missing information from one eye is replaced by the other. With some manipulation of the visual input shown in **Figure 5.10**, however, you can identify your blind spot.

optic nerve the bundle of axons of ganglion cells that carries visual information from the eye to the brain.

Rods and cones are not evenly distributed throughout the retina. Cones are concentrated more in the centre than the periphery of the retina. The **fovea**, the region of the retina where our vision is at its sharpest, is entirely made up of cones. Rods are distributed throughout the rest of the retina and, unlike cones, are concentrated at the peripheral edges of the retina. Have you ever noticed that your peripheral vision is not particularly acute? It mostly enables you to detect movement, but not necessarily details. This is due to that fact that rods dominate the peripheral parts of the retina.

fovea centre of the retina, containing only cones, where vision is most clear.

Like the other sensory systems we previously discussed, the visual system also undergoes sensory adaptation. Dilation and constriction of the pupil, the opening in the centre of the iris, is one way that the visual system adapts to light. When you go from inside your home to outside on a bright, sunny day, you may immediately feel the need to squint and shade your eyes. Your eyes quickly adapt to the brighter light, however, in part by constriction of the pupil that decreases the amount of light entering the eye. Conversely, to allow vision to occur in dark places, such as when you first enter a dark movie theatre, the pupil will open

further to let in more light.

Seeing in Colour

As we noted earlier, cones enable us to see colour. In fact, colour exists only in the brain. An object reflects a particular wavelength, which is then detected by the cones, creating chemical changes that in turn generate a neural signal. This signal is processed by the brain, giving rise to the sensation of colour. How does the brain experience so many colours? The experience of colour can be described along three dimensions: hue, saturation, and brightness. The variety of colours we can perceive is related to the different combinations of these three characteristics. In fact, using these three dimensions it has been estimated that humans can detect about seven million different colours (Geldard, 1972). Not surprisingly, people can only name a small subset of these colours!

Hue refers to the experience of colour based on the wavelength of light that the visual stimulus emits or reflects. This is the most basic aspect of colour, whether the stimulus is perceived as red, green, orange, blue, yellow, or some other colour.

Saturation refers to the purity of a colour; that is, how bright or vivid the colour appears. If a colour is desaturated, it has white or grey mixed into it. For example, a pure red would be saturated, pink would be more desaturated, and grey would be completely desaturated (i.e., zero saturation).

Brightness of a colour refers to how much light emanates or is reflected from the visual stimulus (light intensity). White is considered to be the brightest colour and black the least bright.

Theories of Colour Perception

No single theory yet entirely explains how we perceive colour. Two theories of colour vision in combination help to explain a good deal, however. One theory, first hypothesized in the nineteenth century, is the *Young-Helmholtz trichromatic theory* of colour vision. This theory maintains that there are three different receptors for colour and that each type of receptor responds to a different range of wavelengths of light (Balaraman, 1962). This theory is largely correct, in that people with normal colour vision have three receptor types (cones), each maximally sensitive to a particular wavelength (colour). One receptor type responds to yellowish-red wavelengths, another to green wavelengths, and the third to bluish-purple wavelengths. Why is it that we can see more than three colours if we only have three receptor types? Typically, at least two cone types will respond to a certain wavelength of visible light, but in varying increments. The combination of the signals produced by cones is what enables the brain to respond to such a multitude of colours.

Another nineteenth century theorist, Hering, proposed an alternative theory about colour vision called *opponent process theory* (Buchsbaum & Gottschalk, 1983). Opponent process theory maintains that colour pairs work to inhibit one another in the perception of colour. In the retinal ganglion cells, as well as the thalamus and visual cortex, colour information is analyzed in terms of antagonistic opponent colour pairs: red–green, yellow–blue, and black–white. The hypothesis of antagonistic colour-pairings is supported by the observation that we cannot mix certain combinations of colours. For example, we cannot see reddish green or bluish yellow, but we can see greenish yellow or bluish red. Opponent

processing is the result of activity in a region of the thalamus that receives visual information, called the *lateral geniculate nucleus*. Inputs to this nucleus from one colour of an opposing pair inhibit those from the other colour in the pair. For example, some neurons here are turned on (excited) by red and off for green (inhibited). Other neurons are turned off by red and on for green, and so on for the other opponent pairs (DeValois & DeValois, 1975).

You can observe opponent processing at work by staring at the white dot in the middle of the green and black flag in **Figure 5.11**. After about 30 seconds, stare at a white sheet of paper. You will see a negative *afterimage* that is red and white.

FIGURE 5.11 The negative after-image effect Afterimages occur because one colour in an opponent pair is fatigued when it is viewed for a sustained period of time. When you look away from the first colour, the previously inhibited colour is activated. To see opponent processing in action, stare at the white dot in the centre of the leaf for about 30 seconds, then look away at a white sheet of paper. Reprinted with permission of John Wiley & Sons Canada, Ltd., from Huffman, 2013. *Visualizing Psychology* (2nd Canadian ed.). Toronto: Wiley, p. 119.

The term "negative" is used to acknowledge that the afterimage is the opposite colour of the original image. This also works with other colours in the opponent pairs. A white-on-black image will produce a black-on-white afterimage, and a yellow image will produce a blue afterimage. Afterimages happen when one colour in an opponent pair inhibits the other. When we release this inhibition by looking away from the first colour, the previously inhibited colour overcompensates and creates an image in the opponent colour.

About 1 in 12 men and 1 in 200 women have some form of colour blindness. Most people (99 percent) who have what is called *colour blindness* are unable to distinguish certain colours (more accurately called *colour vision deficiency* or *CVD*). These individuals are not really blind to colour, but instead fail to see the same range of colours as individuals with normal vision. Only 1 in about 33,000 people, those who are *monochromatic*, are actually unable to see any colours at all and instead see a black and white and grey view of the world (Wong, 2011). The most common form of colour deficiency is red–green colour blindness, which is tested with images, such as the one shown in **Figure 5.12**. Studies suggest that people with this problem have a shortage of cones that respond to either the greenish or reddish wavelengths and therefore have what is more accurately called a *colour weakness*. In these cases people mix up all colours that have some red or green as part of the colour. For example, a person with red–green colour blindness might mix up a shade of blue with a shade of purple because they would have difficulty "seeing" the red in the purple colour (Goldstein & Brockmole, 2016). Colour blindness is typically inherited but can also be acquired through diseases, medication, or aging (Simunovic, 2016).

FIGURE 5.12 Colour blindness People with red–green colour blindness would see only a random pattern of dots in this figure.

In sum, trichromacy theory and opponent process theory are not in conflict and can be used together to create a successive physiological two-stage model of colour vision. In stage one, the cones in the retina respond to three primary wavelengths and send signals to the visual cortex. Along the way, in stage two, the signal is processed by opponent process cells. The result? Colour.

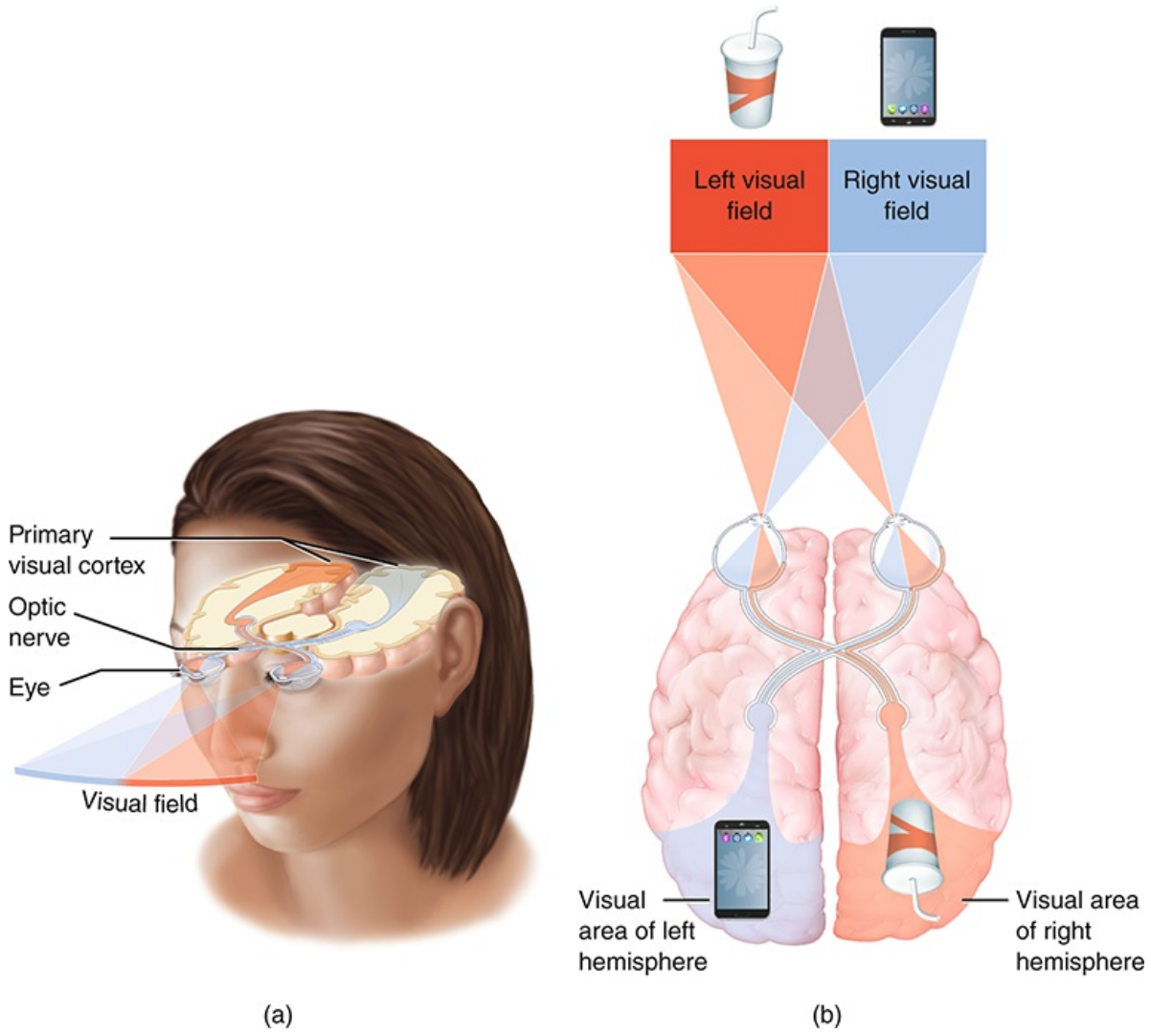


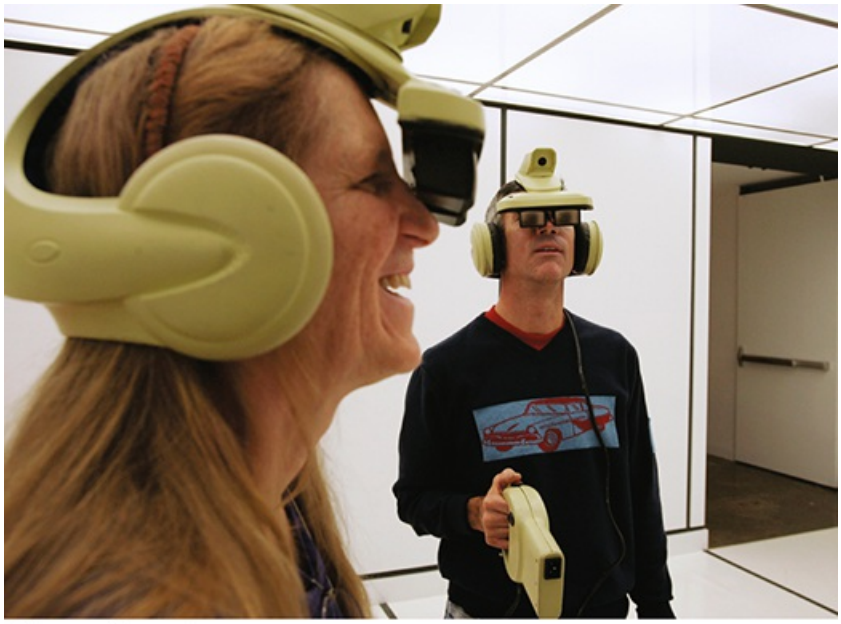
FIGURE 5.13 The crossed visual pathway **Before entering the brain, the optic nerves partially cross. Visual information from the middle part of your visual field travels to opposite sides of your visual cortex, while information from the lateral part of the field (closest to your temples) travels to the same side of the visual cortex.**

The Brain and Sight

Visual information leaving the retina travels via the optic nerve to neurons in the *superior colliculus*, and then communicates with the thalamus. From the thalamus, visual input travels to the primary visual cortex, located in the occipital lobe.

Basic visual information is transmitted throughout the brain via a partially-crossed set of axons (Figure 5.13). Visual information from the middle part of your visual field, closest to your nose, is sent, via axons that cross to the other side of your brain, to the opposite side of your visual cortex. Visual information from the lateral part of your visual field, closest to your temples, travels to the same side of the visual cortex.

Once visual information reaches the primary visual cortex, it is processed to enable the detection of very simple features, such as lines and edges (Hubel & Wiesel, 1959). However, we don't see the world as a collection of lines and edges. Instead, we see a rich set of complex visual stimuli that change as we and the world around us move (see photo). Detection of complex visual stimuli occurs as a result of circuitry that involves association areas of visual cortex. Recall from our discussion of hearing that association areas are involved with higher-order processes of perception: thinking and memory.



AP Images/Steven Senne

Changing one's view **These two people at the Sensorium exhibit at M.I.T. wear wireless head gear that causes each of them to view the world from the visual perspective of the other. You eventually adjust to this visual manipulation, but for a while it interferes with many aspects of visual functioning, including shape, light, and colour perceptions; activity in visual regions of the brain; depth perception; and perceptual constancies.**

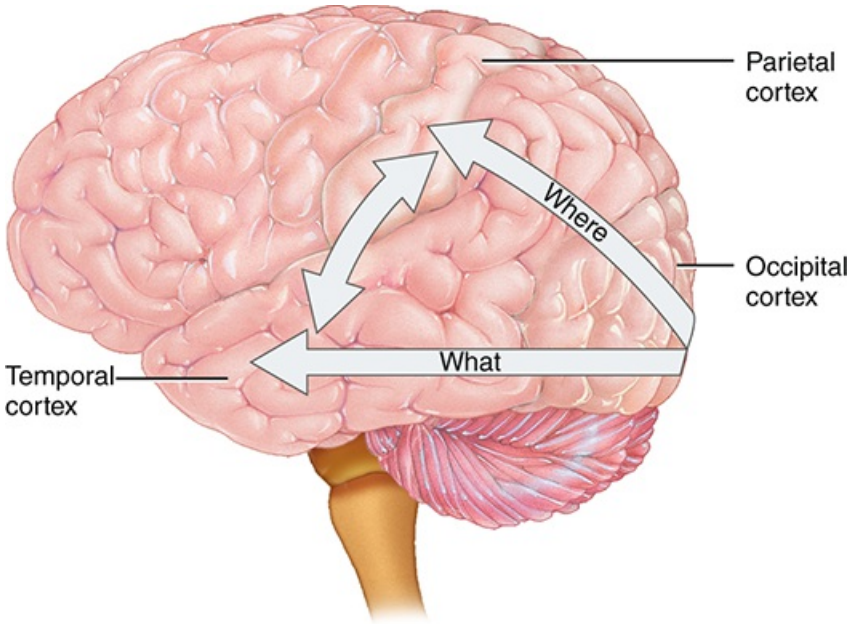


FIGURE 5.14 The "what" and "where" pathways The "what" pathway of the brain processes information that helps us identify an object, while the "where" pathway helps us identify its location in space. Communication between the two pathways allows us to integrate complex visual stimuli.

The pathways that process information about complex visual stimuli can be roughly divided into the "*what*" and the "*where*" pathways, as shown in **Figure 5.14** (Ungerleider & Haxby, 1994). That is, the regions that process visual information to help us determine *what* is the identity of an object (is it an apple, a car, or a house) are different from those where we process the visual information to figure out *where* in space the object is located (is the apple on the table, under the table, or behind the table). The "what" pathway involves axons that travel from the occipital cortex to the temporal cortex; the "where" pathway involves axons that travel from the occipital cortex to the parietal cortex.

How do researchers know about the brain regions that serve these complex functions? One way scientists have determined the function of certain brain regions is by examining the deficits displayed by people who have sustained damage in particular areas of their brains, usually as a result of stroke, disease, or head trauma. Patients with damage to the parts of the temporal cortex that house the "what" pathway exhibit a condition called *visual agnosia*. Although their vision remains intact, they cannot recognize objects visually. When shown a rose, they can describe it, but they cannot name it. If they are allowed to touch or smell the rose, however, they can immediately identify it as a rose. A more specified form of visual agnosia that happens to people with damage to a certain part of the "what" pathway is called *prosopagnosia* (see photo). Individuals with prosopagnosia cannot recognize faces (Shah, 2016). Sometimes these patients can recognize familiar individuals by concentrating on some visual characteristic that is not directly related to facial features, such as the person's hairstyle or eyeglasses, but their ability to recognize the face itself is lost (Lander, Humphreys, & Bruce, 2016).

Argument/Getty Images

Prosopagnosia People with prosopagnosia would see others like this and would need to recognize their friends by features other than their face—like their hat or hair, perhaps.

Patients with damage to the "where" pathway have normal vision, but they have lost the ability to locate objects in space. For example, when given the task of pouring water from a pitcher into a glass, they will invariably miss and pour the water onto the table or floor. A very peculiar form of damage to the "where" pathway results in a condition called *hemi-neglect* (Harrison, 2015). Patients with hemi-neglect often completely ignore one side of their visual field. Hemi-neglect is most apparent and long-lasting after damage to the right hemisphere. People with damage to the right side of their "where" pathways neglect the left side of their visual field. For example, when asked to copy a drawing, people with hemi-neglect will leave out one half of it (Figure 5.15). People with this condition have been known to apply makeup to only one side of their face, to shave only one side of their face, and to eat food on only one side of their plate (Danckert, 2014).

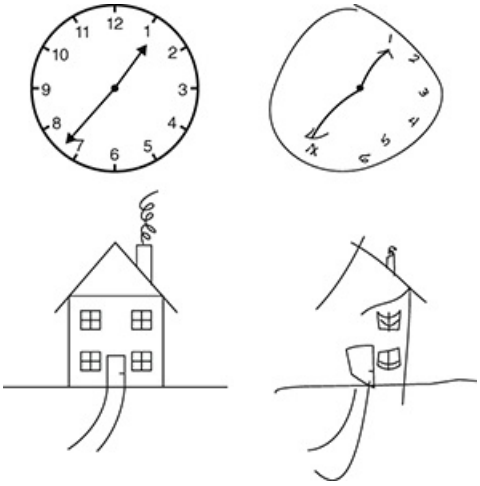


FIGURE 5.15 Seeing only half the picture When asked to copy a drawing of a clock and a house, a patient with hemi-neglect copies only the right side of each image.

She ignores the left side of her visual field.

In addition to the information researchers have gained from studying patients with brain damage, neuroimaging studies of people without brain damage have confirmed the presence of the "what" and "where" pathways. Indeed, these types of studies have shown that brain activity changes in specific parts of the "what" and "where" pathways when the participants are engaged in tasks remembering the location of objects versus the identity of objects (Rottschy et al., 2013).

Visual Perceptual Organization: From the Top Down

So far we have discussed vision from a bottom-up perspective. Light comes in through the eye and the neural impulses generated are passed to successively more complex brain regions that ultimately result in the perception of a visual stimulus. Equally important to visual perception, however, is *top-down processing*, which involves previously acquired knowledge. Like perception involving the other sensory systems, visual perception involves both bottom-up and top-down processing occurring at the same time. Brain regions that store information about what objects look like can help us to perceive visual stimuli that are partially hidden or of a different size from when we originally encountered them.

Putting Together the Parts: Gestalt Principles

We don't see images as a series of small patches of colour or a series of simple features. Instead, our visual system assembles this information into coherent objects and scenes. Even when we see a small part of an object or scene partially obscured by another object, we are able to perceive it as a whole, given limited visual information. Our brains are organized to fill in the missing parts so that we perceive and recognize meaningful stimuli. As we described earlier, part of our ability to perceive images comes from our use of cognitive processes, such as memory and learning, to help us recall images from prior experience that match the stimuli we are sensing.

The area of study focused on understanding principles by which we perceive and recognize visual stimuli in their entirety despite limited information is called *Gestalt* psychology. As mentioned in Chapter 1, Gestalt psychologists believe that perception helps us to add meaning to visual information by attempting to organize information into groups, so that the whole is more than the sum of its parts. As Kurt Koffka pointed out, though, "*It is more correct to say that the whole is something else than the sum of its parts, because summing up is a meaningless procedure, whereas the whole-part relationship is meaningful*" (Koffka, 1935, p. 176). Gestalt psychologists have identified several laws by which visual information is organized into coherent images; a few of these laws are listed below (see also **Figure 5.16**):

Figure ground perception is used to identify whether something in the visual field is the main object or the background. Illusions, or unstable perception, can be created when the figure and the background are interchangeable. The figure is generally perceived to be closer than the background.

Proximity The law of proximity indicates that visual stimuli near to one another tend to be grouped together. For example, AA AA AA is seen as three groups, while AAA AAA is seen as two groups, despite the fact that each set has six As.

Continuity The law of continuity indicates that stimuli falling along the same plane tend to be grouped together. $_{AAA}$ ^{AAA} would be organized into two perceptual groups because they are not on the same line.

Closure The law of closure indicates that we tend to fill in small gaps in objects so that they are still perceived as whole objects.

Similarity The law of similarity indicates that stimuli resembling one another tend to be grouped together. So AAaa is viewed as two groups because of the dissimilar appearance of upper and lowercase letters.

These laws of visual organization put together all the "pieces" of visual stimuli to complete a "puzzle" to build meaningful information from everything we see when we look at something. A similar illusion, Magnetic Hill, known as a gravity hill, is created by the surrounding terrain. Sometimes, however, the fact that our brain tends to create order among the things we are seeing can lead us to perceive sights that are illusions, such as the one shown in **Figure 5.17**. If you look closely, you can see that the drawing depicts a situation that is simply physically impossible. Although parts of the drawing are reasonable, they cannot be combined to create a meaningful holistic figure (Macpherson, 2010).

Figure ground:
The tendency to perceive one aspect as the figure and the other as the background. You see a vase or two faces, but not both at the same time.

Proximity:
Objects that are physically close together are grouped together. (In this figure, we see 3 groups of 6 hearts, not 18 separate hearts.)

Continuity:
Objects that continue a pattern are grouped together.

When we see this,

we normally see this

plus this.

Not this.

Closure:
The tendency to see a finished unit (triangle, square, or circle) from an incomplete stimulus.

Similarity:
Similar objects are grouped together (the green coloured dots are grouped together and perceived as the number 5).

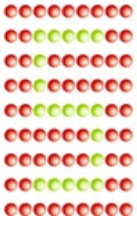


FIGURE 5.16 Gestalt laws Gestalt psychologists studied how we perceive stimuli as whole forms or figures rather than individual lines and curves.

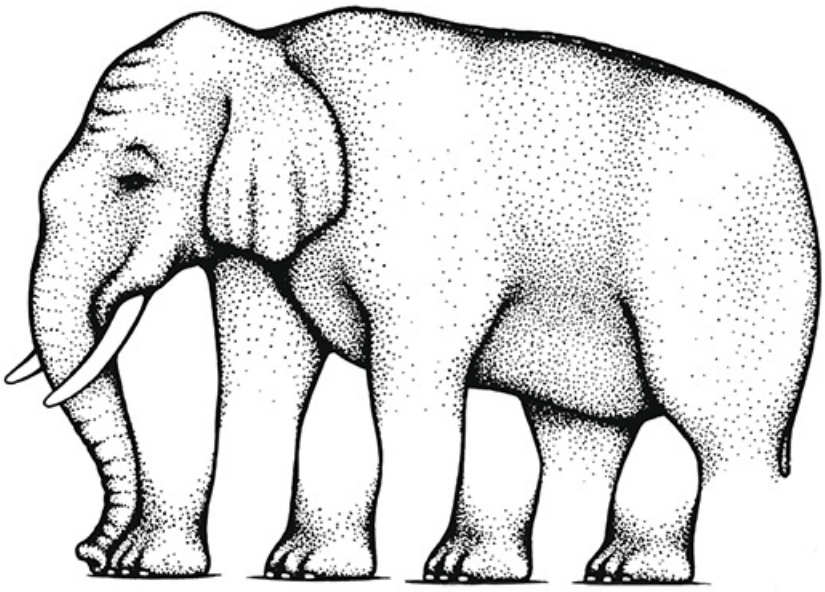


FIGURE 5.17 Impossible figure The brain is organized to perceive meaningful images; with impossible figures such as this, the brain tries but cannot form a stable perception. How many legs does this elephant have?

Reprinted courtesy of Roger N. Shepard. Source: Roger N. Shepard, *Mind Sights: Original Visual Illusions, Ambiguities, and Other Anomalies, With a Commentary on the Play of Mind in Perception and Art.* (New York: W.H. Freeman, 1990) Print.

Getting in Deep: Binocular and Monocular Cues

When you look at the items on the table in a restaurant, how do you know which items are closer to you and which are farther away? We use a number of methods for depth perception, that is, determining the distance of objects away from us and in relation to one another, by using types of cues: *binocular cues* (requiring both eyes) and *monocular cues* (requiring one eye).

Department of Tourism & Parks, New Brunswick, Canada

Sometimes what we expect is not what we get **Magnetic Hill near Moncton, New Brunswick, creates an odd impression. Which way would you expect this car to roll if it is placed in neutral and its brakes released? It looks like it should roll away from the camera, but in fact it would roll back toward the camera. The explanation has nothing to do with magnetism, but is rather an optical illusion created by the landscape suggesting that the hill runs the opposite of the way it is actually sloped.**

Because our eyes are set a slight distance apart, we do not see exactly the same thing with each eye. This **retinal disparity**, the slightly different stimuli recorded by the retina of each eye, provides us with a *binocular* cue of depth (**Figure 5.18**). Our brains use the discrepancies between the visual information received from our two eyes to help us judge the distance of objects from us. You can observe your own retinal disparity by holding up a finger at arm's length away from your face. Close first one eye, then the other, and note how the position of your finger seems to change relative to objects in the background beyond the finger.

retinal disparity the slight difference in images processed by the retinas of each eye.

Another binocular cue to depth is actually tactile. We feel the changes in the muscles around our eyes as we shift them to look at objects at various distances. Closer objects require more convergence, turning our eyes inward toward our noses. Use your finger again to demonstrate **convergence**. Start with the finger at arm's length from you and watch it as you bring it closer and closer to your face. Note the sensations you feel as you do so.

convergence inward movement of the eyes to view objects close to oneself.

In addition to these binocular cues, we also use **monocular cues** cues to determine depth in two-dimensional space, such as pictures or photographs, or when distances are so great as to render binocular perspectives imperceptible. (Schiller et al., 2011). Monocular cues help us judge depth based on information from only one eye. Examples of some of the monocular cues described below can be viewed in **Figure 5.19**.

monocular cues visual clues about depth and distance that can be perceived using information from only one eye.

Interposition When one object blocks part of another from our view, we see the blocked object as farther away.

Relative height (elevation) We see objects that are higher in our visual plane as farther away than those that are lower in the visual plane (see photo).

Texture gradient We see more details of textured surfaces, such as the veins in leaves, when the object is closer to us. Thus the finer (less detailed or distinct) the view of the textured object, the farther away we assume it to be.

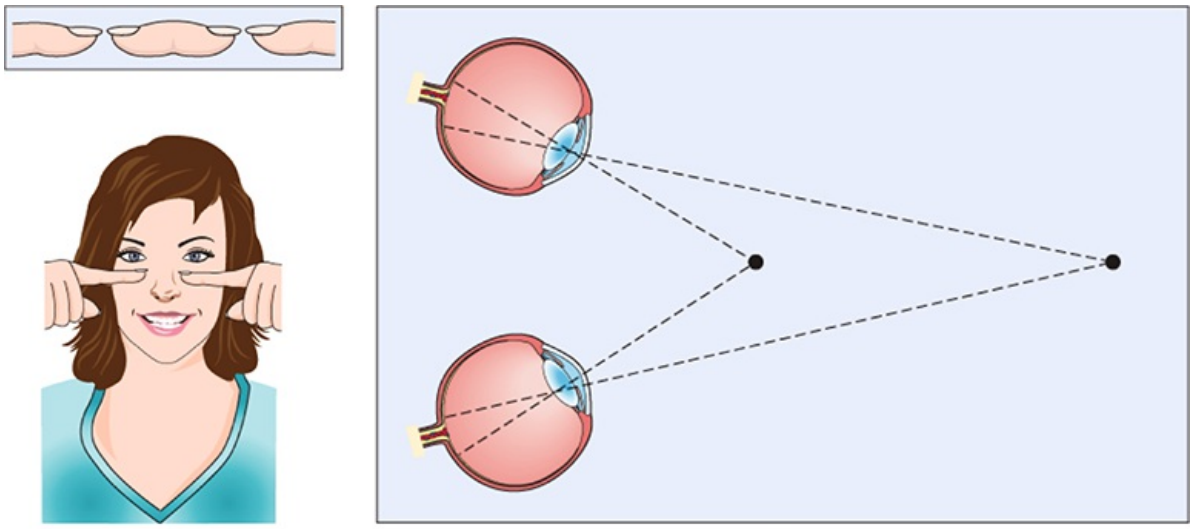


FIGURE 5.18 Retinal disparity (a) Stare at your two index fingers a few centimetres in front of your eyes, holding the tips about half a centimetre apart. Do you see the "floating finger"? Move your fingers farther away and the finger will shrink. Move them closer and it will enlarge. (b) Because of retinal disparity, objects at different distances project their images on different parts of the retina. Far objects project on the retinal area near the nose, whereas near objects project farther out, closer to the ears.

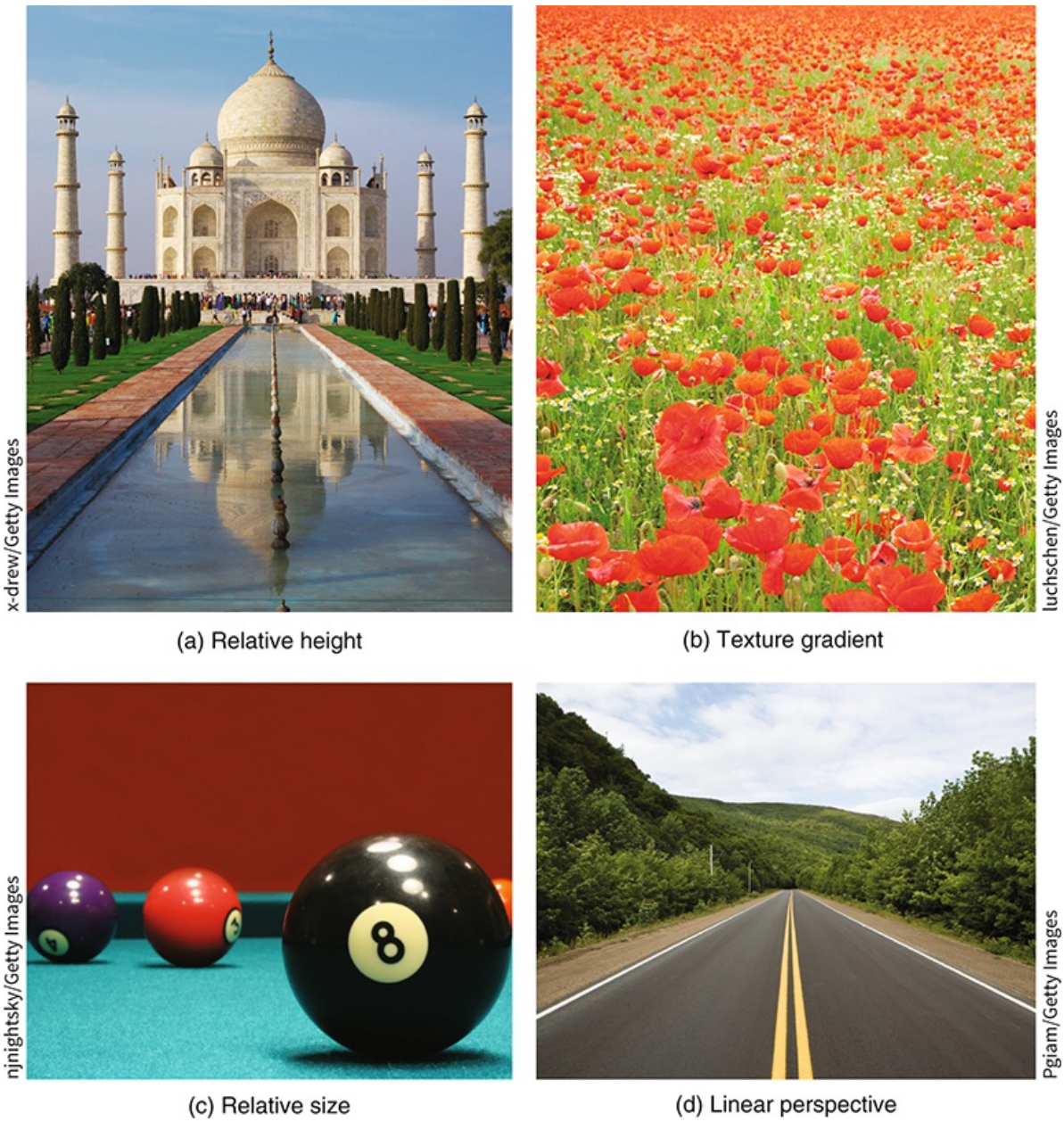


FIGURE 5.19 Monocular cues

Linear perspective Parallel lines seem to get closer together (or converge) as they recede, creating the illusion of depth or distance. That is, we know that the lines remain parallel and therefore perceive the appearance of convergence as a cue to distance.

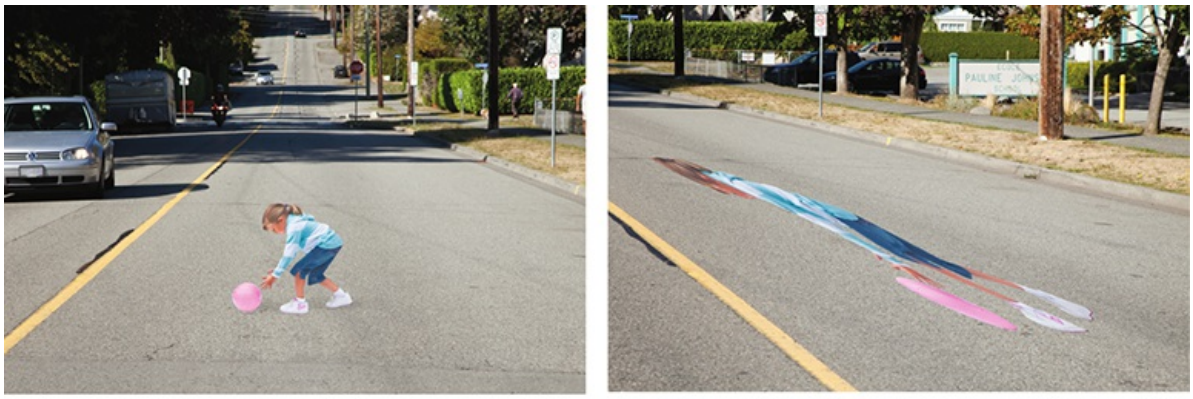
Light and shadow We use light as a cue to distance. Objects that are bright are perceived as closer, whereas objects that are dark, or shaded, appear farther away. As well, we are accustomed to light, such as sunlight, coming from above us. We therefore use differences in shading to judge size and distance of objects.

Clarity or aerial perspective We tend to see closer objects with more clarity than objects that are farther away. This is also sometimes referred to as a fog or smog effect.

Familiar size Once we have learned the sizes of objects, such as people or buildings or trees, we assume that they stay the same size, so objects that look smaller than usual must be farther away than usual.

Relative size When we look at two objects we know are about the same size, if one seems smaller than the other, we see the smaller object as farther away.

Motion parallax This monocular depth cue requires that the observer be moving. Here the relative movement of objects that are stationary against their background gives us an idea about their relative distance. For example, if we look out the side window of a moving vehicle, objects that are closer to us appear to move past us more quickly than do objects that are farther away (and very distant objects, like mountains, sometimes do not appear to move at all).

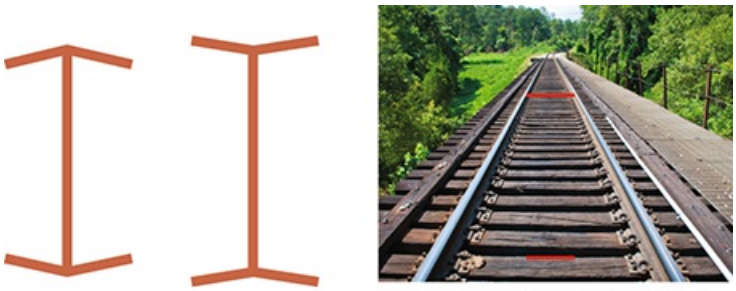


Wasserman & Partners Advertising

Pavement Patty Would seeing this on the road ahead slow you down? The British Columbia Automobile Association (BCAA) Traffic Safety Foundation and West Vancouver District had an artist design a decal that when applied flat on the road creates a three-dimensional image of what appears to be a child on the road. The image of "Pavement Patty," which plays with our two-dimensional depth cues, really made drivers slow down during its week on the road.

Although some studies show that we can perceive depth at very early ages, and may even be born with some depth perception abilities, top-down processing may play a part in depth processing (Firestone & Scholl, 2015). We use our memories of the sizes of objects around us, for example, to help judge depth.

Artists use monocular depth cues to help us "see" depth in their two-dimensional representations. In essence, they create an illusion of depth. Because visual perception happens nearly automatically, we are quite susceptible to such visual illusions. For example, people from cultures that have a lot of architecture and structures featuring straight edges, such as Canada and the U.S., are easily fooled by the Ponzo illusion and Müller-Lyer illusion, shown in **Figure 5.20**, which both take advantage of our tendency to use linear perspective to judge distance (Masuda, 2010).



WendellandCarolyn/Getty Images

(a) (b)

FIGURE 5.20 Perceptual illusions (a) The Müller-Lyer illusion: The line on the right appears longer, but both lines are the same length. (b) The Ponzo illusion: The converging lines make the upper bar seem larger, but both bars are identical in length.

Seeing What We Expect to See: Perceptual Constancies

Top-down processing also contributes to **perceptual constancies**, our tendency to view objects as unchanging in some ways, even though the actual visual sensations we receive are constantly shifting (Goldstein & Brockmole, 2016). We tend to see the food on our plate as the same colours, for example, even when a restaurant owner dims the lights for the evening and the actual light waves we are receiving change in intensity, a phenomenon known as *colour constancy* (Faruq, McOwan, & Chittka, 2013).

perceptual constancies our top-down tendency to view objects as unchanging, despite shifts in the environmental stimuli we receive.

FionaAyerst/Getty Images

The moon illusion The moon is the same size all the time, but it appears larger near the horizon than higher in the sky, partly because no depth cues exist in

space.

Another constancy, *size constancy*, helps us in depth perception, as noted above. Once we have learned the size of an object, we expect it to stay the same. Top-down processing, based on our memory of the object's size, leads us to assume that if it looks smaller than usual, it is probably far away, instead of thinking that the object has somehow shrunk. As with our other perceptual processes, perceptual constancies, while usually very useful in helping us understand the world, can sometimes lead us to "see" illusions (see photo of Pavement Patty). A common size illusion, for example, is the moon illusion (see photo). The moon stays the same size all the time, but when we view it close to a horizon, it appears much bigger than when we see it farther from the horizon; the landscapes and objects we are viewing the moon through strip away some of the size constancy effect and we see the moon as larger (Weidner et al., 2014).

Once we have formed expectations about the shape of an object, we also experience *shape constancy* (Hatfield, 2014). We may get visual input of only the edge of a plate as our server carries it toward us, for example, but we perceive the plate as a round disk. A famous illusion based on both shape and size constancy involves the Ames room, shown in **Figure 5.21**. The person on the right-hand side looks huge compared with the one on the left. Why? First, we expect the room to be square, but it actually is irregularly shaped. Second, because we think the room is square, we believe that both people are the same distance from us, leading us to perceive one as much larger than the other. You may notice that even when you know how this illusion works, the people's respective sizes don't look right—indicating how strongly our expectations affect our perception. A number of Ames room sets were built for the *Lord of the Rings* movies to help make the hobbits appear smaller than Gandalf or Aragorn. Our senses most often help us, but sometimes they let us down. The Psychology@Work video on Applied Sensation and Perception looks at the industrial/organizational psychology area known as human factors, which studies things like how cars can be better designed to reduce human errors that lead to collisions.

Video **PSYCHOLOGY@WORK**

Applied Sensation and Perception **This video looks at the industrial/organizational psychology area called human factors. As the name suggests, it examines ways in which our sensory processing and attentional systems provide us with both advantages and, sometimes, dangerous disadvantages, such as the consequences of limited attention and distraction while driving.**

How Sight Develops

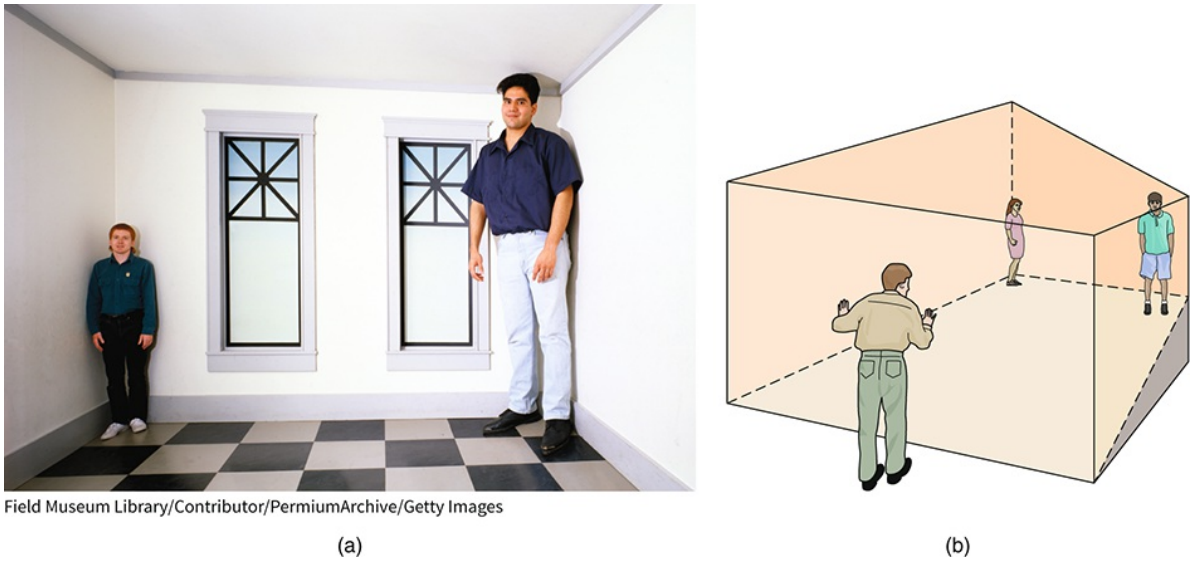
Newborn infants are capable of seeing, but their visual acuity is much less than it will be after a few months. For a short time after birth, human babies focus mostly on contrasts. For example, babies will stare at the hairline of their caregiver instead of the face.

By the time babies are about 2 months old, visual acuity has improved and infants seem to focus intently on faces. Their focal range is limited, though. They see objects best that are within a foot (about 30 cm) away. Perhaps not coincidentally, this is about the distance

people tend to place their faces when interacting with babies. Over the next several months, babies' visual acuity improves so that by the end of the eighth month, their vision is quite similar to that of normal adults (Braddick, 2012). These early life changes in vision are due to the postnatal development of the visual nervous system. As we will see next, proper development of the visual system requires visual experience during a specific part of early life.

Visual Loss

Today, many common vision problems can be corrected. Increasingly common laser surgeries or the lenses in glasses or contacts can help people cope with nearsightedness, or difficulty seeing things clearly far away, and farsightedness, problems seeing near objects clearly, for example. Eye-care practitioners help with a variety of other problems as well. Sometimes, however, there is no treatment available, or treatment is begun too late to prevent people from losing vision in one or both eyes.



Field Museum Library/Contributor/PermiumArchive/Getty Images

(a) (b)

FIGURE 5.21 The Ames room This specially constructed room is trapezoidal in shape, with sloping floors and ceilings. An observer can see inside only through a peephole, using one eye, so that the room appears normal. Because the observer assumes both people in the room are the same distance from him, he "sees" the people as being very different in size.

Strabismus

Typically both eyes coordinate and look in the same direction at the same object at the same time, sending a focused image to the brain. However, in 2 to 4 percent of cases, the eyes are misaligned. This misalignment is called *strabismus*. A child may be born with strabismus or the condition may be acquired later as a result of an accident or other health-related issue. Regardless of the cause, two different images are being sent to the brain—one from each eye—and if this situation is not resolved early it can result in visual loss as the child's brain will ignore the images from the weaker eye (Goldstein & Brockmole, 2016).

alle12/E+/Getty Images

A life of accomplishment **Braille, devised in 1821 by Frenchman Louis Braille, has greatly improved the level of accomplishment and quality of life of people who are sightless.**

Amblyopia

Amblyopia is a partial or complete loss of vision due to abnormal development of the brain's visual cortex in infancy. Amblyopia is caused by one eye focusing better than the other due to a number of causes, including an extreme refractive error in one eye (due to farsightedness, nearsightedness, or astigmatism) or to a cataract (cloudy lens) on one eye. However, the most common cause of amblyopia is strabismus (Tychsen, 2012). If the ocular misalignment associated with strabismus remains uncorrected past about 6 years of age, it will eventually lead to a loss of visual abilities in the weaker eye. Occasionally amblyopia causes strabismus. For example, a child might have a cataract on one eye causing abnormal development in the visual cortex, which in turn causes ocular misalignment (Tychsen, 2012). In this case, the cataract would be treated and then the strabismus would be treated.

Strabismus is commonly treated by surgery or by having the child wear a patch over the stronger eye, thus forcing the child to strengthen the weaker one. If children are treated during early life, their normal binocular vision can be preserved (Read, 2015; Stewart, Moseley, & Fielder, 2011).

Visual Impairment

About half a million people in Canada suffer from visual impairments and each year 50,000 Canadians lose their sight. In addition, over 5.5 million Canadians have a disease, such as age-related macular degeneration, glaucoma, diabetic retinopathy, cataracts, and refractive error, that could cause visual loss (Canadian National Institute for the Blind, 2017). There are many potential causes of loss of vision. Some are congenital, or present at birth, while others are acquired later in life.

Since humans rely so heavily on visual information, living without adequate visual input is very challenging. A number of devices have been created to help those who are visually

impaired live independently. Braille, a system of reading that involves touch, has significantly improved quality of life for those with loss of vision (see photo). Braille uses various combinations of raised dots to replace traditional printed letters and numbers. Visually impaired individuals can become so proficient at reading Braille that they can actually read faster than people with normal vision typically read printed material. Researchers have found that individuals with vision loss who become experts at reading Braille are actually using parts of their "visual" brain to process the sophisticated tactile information (Fine & Park, 2018; Siuda-Krzywicka et al., 2016).

The visual cortices of adults, congenitally blind from birth, respond to touch, sound, and spoken language. Developmental studies indicate that the visual cortex response to nonspeech sounds increases from ages 4 to 17 (Bedny et al., 2015). However, neuroimaging studies have also shown that parts of the occipital and temporal cortices that normally process visual information are activated in individuals with vision loss while they read Braille. Moreover, individuals with congenital vision loss use more of their "visual" brains to read Braille than do those who lose their vision later in life.

Thus, the acquisition of Braille reading skills as a child allows for the reorganization of the visual system to serve this new function. That is, visual cortex becomes rewired to respond to written and spoken language in blind children (Bedny, 2017). Learning Braille later in life may lead to less dramatic reorganization because those parts of the visual brain have already become "hard-wired," or less plastic and open to change (McGrath & Astell, 2016). Such studies in plasticity provide important information about how experience shapes the brain.

The Other Senses: Vestibular and Kinesthetic Senses

How do you know when you are moving if your eyes are closed? As you wake up and before you open your eyes, how can you tell if you are lying flat on your bed or are propped up on a bunch of pillows? Why is it that many spinning carnival rides, some movie scenes, and some boat trips make some people throw up? The answers to all of these questions involve your kinesthetic and vestibular systems (see photo). Receptor cells in your muscles respond if they are squeezed and their shape is changed by movement, thus they tell us when our muscles are moving; other cells respond when stretched and tell us that our muscles are working hard. This information tells us whether we are still or moving in a particular direction without having to look—this is our *kinesthetic sense* (Mather, 2016). (See Positive Psychology 5.2.)

Rune Hellestad - Corbis/Getty Images

Movement as art **Highly-skilled acts of contortion and gymnastics, as displayed by these Cirque du Soleil performers, relies on both the kinesthetic and vestibular system.**

Our *vestibular sense* is located in the semicircular canals of our inner ear where the fluid the canals contain shifts as we move in space—standing up, lying down, or swaying from side to side. The movement of the fluid is detected by hair cells embedded in a gelatinous substance that gets shifted around when our inner ear fluid moves and provides special information about our body position (Mather, 2016). Most of the time our vestibular system provides us with body movement and location information that matches the visual information provided by our eyes. However, when we are on a rolling boat, our visual and vestibular information do not match up well and we can start to feel quite ill. Carnival ride-related illness may be partially due to a similar phenomenon, but is also likely due to our inner ear's vestibular reporting functions being overwhelmed by spinning and sudden jerky motions. However, if you start to feel sick at the carnival or on a boat, look into the far (and stable) distance and that may calm your inner ear. If not, try closing your eyes and taking a nap, or try chewing gum; both work to calm the inner ear (Golding, 2017).

5.2 Psychology Around Us | Positive Psychology

Contemporary Circus Performers: Cirque du Soleil and the National Circus School

Contemporary circus acts rely on highly skilled human performances to convey

storylines. A diverse array of highly trained athletes and performing artists work collaboratively to convey a story. Artistic performers integrate extraordinary and complex acrobatic and agility skills with a *mindful mindset* in order to connect with audiences. This means that performers must learn to be in the moment in order to dialogue continuously with audiences. Edson Filho worked with Patrice Aubertin from the National Circus School in Montreal and Bernard Petiot from the Cirque du Soleil in Montreal to interview performance artists in order to better understand the psychological processes and skills needed to excel in a contemporary circus. Circus performers told Filho et al. (2016) that to develop into well-rounded artists, they had to acquire positive efficacy beliefs about themselves as artists, as well as athletes. That is, they had to stop viewing themselves as "only" athletes before they could successfully transfer their highly-developed athletic skills into the more story-based environment of the circus. Successful performers developed artistic identity by pushing physical and mental boundaries in order to ultimately see themselves as "circus artists." For example, a gymnast who previously excelled as an athlete on the uneven bars and balance beam would have to learn how to turn these skills into performance-based skills more useful in a circus setting, learning not only to transition to a trapeze or a tight rope, but also to also convincingly convey an emotional storyline while in the air.

TORSTEN BLACKWOOD/AFP/Getty Images

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

16. What are rods and cones?

17. What are the two theories of colour vision and how do they work together?

18. What do the "what" and "where" pathways in the brain do?

19. What are the two major types of depth perception cues and what is the difference between them?

20. What is strabismus, how is it treated, and what can happen if it is not treated promptly?

21. Where is our vestibular sense located and how does it work?

What Do You Think? • Is the cliché, "Seeing is believing," really true? Why or why not?

5.1 Your Brain and Behaviour

Eating Pizza

Is this the best pizza you have ever had or does it fall short? When you dig into a slice of pizza, several neural circuits are activated to give you the overall experience. The appearance of your food can play an important role in its enjoyment. Photoreceptors in the eye transmit this information to the brain via the optic nerve, which passes through the brainstem, followed by the thalamus, and finally the visual cortex. Taste receptor cells, as well as sensory cells that respond to touch and temperature, are activated on your tongue. These nerves carry impulses into the brain where they pass through the brainstem, thalamus, and sensory cortex (gustatory cortex and somatosensory cortex). Taste is combined with smell information to produce flavour. Olfactory receptor neurons transduce pizza odorants and send this information on to the olfactory bulb and then to the olfactory cortex. (Smell is the only sensory modality that bypasses the thalamus on its way to the cortex.)

Information about taste, smell, texture, temperature, and appearance is integrated in various association regions of the neocortex. These circuits, together with those that store memories related to your previous pizza experiences, work to produce your perception of this particular slice.

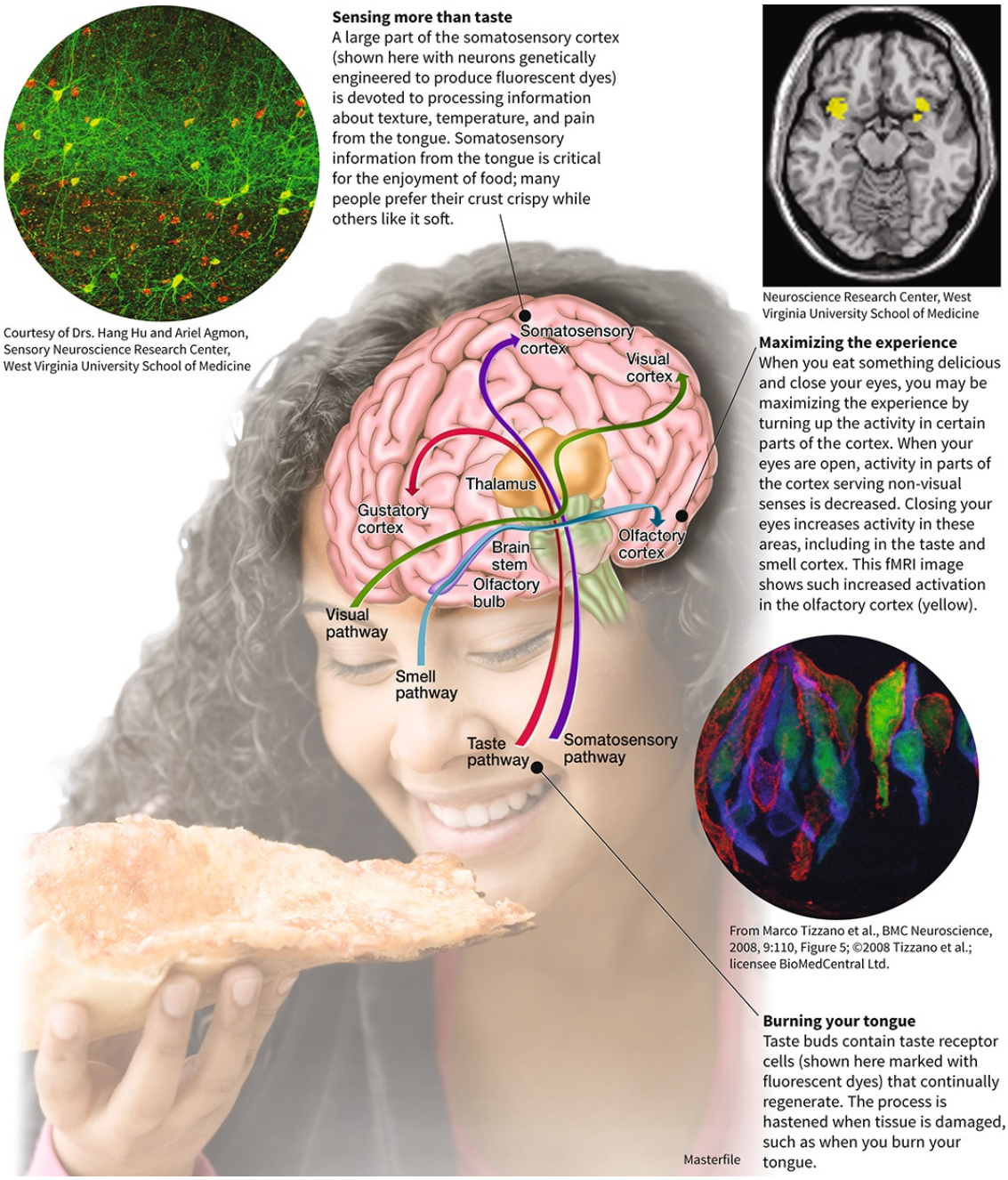
Questions

Explain how multiple senses (vision, smell, taste, touch) are involved in our experience of eating.

Explain how the taste of food may be enhanced if we close our eyes.

Which areas of the brain are responsible for integrating information about various components of eating (e.g., taste, smell, texture)?

Emir Memedovski / Getty Images



Summary

Common Features of Sensation and Perception

LEARNING OBJECTIVE 1 Describe characteristics shared by all the senses, including receptor cells, transduction, and thresholds, and differentiate between top-down and bottom-up processes of perception.

Our sensory systems convert physical stimuli into neural information with specialized

cells called sensory receptor cells that convert a specific form of environmental stimuli into neural impulses by a process called sensory transduction.

The conversion of physical stimuli into neural impulses only occurs when the stimuli reach a certain level, or threshold. The absolute threshold is the minimum level of a stimulus we can detect. The difference threshold is the smallest difference we can detect between two similar stimuli.

Our sensory systems are set up to detect change. With continuous exposure to a stimulus, adaptation occurs.

Bottom-up processing begins with the physical stimuli from the environment and proceeds through to perception. In top-down processing, prior knowledge is used to interpret perceptual information.

The Chemical Senses: Smell and Taste

LEARNING OBJECTIVE 2 Summarize the biological changes that underlie smell and taste.

Smell, our olfactory sense, converts chemical odorants into neural signals that the brain can use. Taste, our gustatory sense, is closely intertwined with smell. Most flavours are a combination of scents with the five basic tastes we can discern: sweet, salty, sour, bitter, and umami.

Taste buds in papillae on the tongue convert chemicals in our food to neural signals the brain can use. Taste receptors and smell receptors are routinely replaced, since they are more vulnerable to damage than other sensory receptors.

Information about smell goes directly from the olfactory bulb to the olfactory cortex. Areas of the brain that process smells and tastes are plastic, or changeable. Processing of smells also sometimes overlaps with emotions and memories.

Our preferred tastes change as we mature from childhood to adulthood, probably from a combination of learning and physical changes in the mouth.

True disorders of taste are rare; people more frequently lose part or all of their sense of smell. Anosmia can present safety risks and diminish pleasure in life.

The Tactile or Cutaneous Senses: Touch, Pressure, Pain, Vibration

LEARNING OBJECTIVE 3 Describe how the different senses of touch work and what can happen when things go wrong.

A variety of sensory receptors throughout our bodies convert touch, pressure, or temperature stimuli into neural impulses that our brains can perceive.

The sensory cortex of the brain maps touch sensations. Especially sensitive or important body parts receive disproportionately large representation in the cortex.

Pain travels to the brain via both a fast pathway and a slow pathway.

The gate control theory of pain suggests that certain patterns of neural activity can close a “gate” so that pain information does not reach parts of the brain where it is perceived.

Medical professionals continue to search for ways to relieve people's chronic pain. Opiate drugs that simulate natural pain-killing endorphins or enkephalins are addictive. Sometimes practitioners resort to neurosurgery, which stops a patient from receiving all touch signals.

People who have lost body parts surgically or through accidents often feel phantom sensations in the missing body part. These may be related to reorganization of the somatosensory cortex after an amputation.

The Auditory Sense: Hearing

LEARNING OBJECTIVE 4 Summarize what happens when we hear.

The frequency and amplitude of sound waves produce our perceptions of pitch and loudness of sounds.

When sounds enter the ear, they move the ear drum, which sets in motion the ossicles. The last of these, the stirrup, vibrates the oval window, setting into motion fluid in the cochlea. Hair cells on the basilar membrane in the cochlea transduce movements along the basilar membrane into neural signals the brain can interpret.

Frequency theory suggests that patterns in the firing rates of the neurons are perceived as different sounds. Place theory suggests that information from different locations along the basilar membrane is related to different qualities of sound.

Top-down processing lets us use the general loudness of sounds, as well as differences in the signals received from each ear, to determine location of a sound.

Different pitches are represented in a tonotopic map in the auditory cortex of the brain. Association areas of the cortex help us recognize familiar sounds, including speech.

As young children, we experience a sensitive period during which it is especially easy for us to learn auditory information, including language and music. Some people, particularly those exposed to pure tones during this sensitive period, develop absolute pitch.

Common hearing problems include hearing loss and deafness, as well as hearing unwanted sounds, such as tinnitus.

The Visual Sense: Sight

LEARNING OBJECTIVE 5 Describe key processes in visual sensation and perception.

Rods and cones in the retina at the back of the eye change light into neural impulses. Cones provide detailed vision and help us perceive colour, while rods provide information about intensity of light.

Two different theories in combination—trichromatic theory and opponent process theory—explain a good deal of how we perceive colour.

The fovea at the centre of the retina contains only cones and provides our sharpest vision. We have a blind spot where the optic nerve leaves the retina to carry information to the brain.

Damage to the brain can produce deficits in sensation, as well as abnormal sensory experiences.

Top-down processing is involved in much visual perception. Gestalt theorists have identified several principles by which we recognize stimuli even when visual inputs are limited. We use binocular and monocular cues for depth perception. Perceptual constancies, based on learning from previous experiences, help us to see things as stable despite constant shifts in our visual inputs. These top-down processes can be "fooled" by visual illusions.

Without adequate visual stimulation through both eyes during a critical period of life, we may not develop binocular vision, a condition known as amblyopia.

Individuals with loss of vision can use other sensory modalities to compensate for the loss of visual information. Learning Braille with touch involves the use of brain areas normally used for vision.

Key Terms

absolute pitch

absolute threshold

ageusia

anosmia

basilar membrane

bottom-up processing

cochlea

cones

convergence

deafness

difference threshold or just noticeable difference

endorphins

enkephalins

fovea

free nerve endings

gate control theory of pain

gustatory sense

hair cells

hyposmia

Meissner's corpuscles

Merkel’s discs
monocular cues
odorants
olfactory bulb
olfactory receptor neurons
olfactory sense
optic nerve
ossicles
oval window
Pacinian corpuscles
papillae
perception
perceptual constancies
perceptual set
photoreceptors
retina
retinal disparity
rods
Ruffini’s end-organs
sensation
sensory adaptation
sensory receptor cells
sensory transduction
signal detection theory
sound waves
taste buds
threshold
tonotopic map
top-down processing
transduction
tympanic membrane

Self-Study Questions

Multiple Choice

1. If a light bulb does not produce a light that can be detected by a person, what threshold has not been surpassed?

a. difference

b. absolute

c. stimulus

d. transduction

2. Which of the following statements most accurately expresses the relationship between top-down and bottom-up processing?

a. Some stimuli are processed in a bottom-up fashion, while others are processed in a top-down manner.

b. Bottom-up processing precedes top-down processing during the perception of most stimuli.

c. Top-down processes only contribute to perception when stimuli are highly novel, unexpected, or ambiguous.

d. Top-down and bottom-up processes occur simultaneously during the perception of many, if not all, stimuli.

3. Which of the following statements most accurately describes the responsiveness of an individual olfactory receptor?

a. A given olfactory receptor responds only to a specific airborne chemical.

b. A given olfactory receptor responds to a wide range of odorants.

c. A given olfactory receptor responds to one of four or five basic classes of odorants.

d. A given olfactory receptor responds to virtually any airborne chemical.

4. Which of the basic tastes are considered rewarding? Which are considered aversive?

a. Salty and sweet are considered rewarding. Sour and bitter are considered aversive.

b. Sweet is considered rewarding. Salty, sour, and bitter are considered aversive.

c. Sweet and sour are considered rewarding. Salty and bitter are considered aversive.

d. Sweet, sour, and salty are considered rewarding. Bitter is considered aversive.

5. Which of the following tactile sensory receptors is *correctly* matched with a function?

a. Merkel's disc—responds to vibrations and heavy pressure

b. Ruffini's end-organ—registers light to moderate pressure

c. Meissner's corpuscle—transduces information about sensitive touch

d. Pacinian corpuscle—registers heavy pressure and movement of the joints

6. With respect to the development of the tactile senses, which of the following statements

is *true*?

a. Although the tactile senses are highly developed at birth, there is still substantial development in these senses for many years following birth.

b. The tactile senses are almost fully developed at birth; there is only minimal development in these senses following birth.

c. Although the tactile senses are poorly developed at birth, the development of these senses is virtually complete by the age of 2.

d. The tactile senses are poorly developed at birth. The developsment of these senses continues for many years following birth.

7. Which theory of audition states that different frequencies are converted into different rates of action potentials in our auditory nerves?

a. tonotopic

b. place

c. frequency

d. association

8. What cues are used to localize sound?

a. loudness in each ear

b. timing

c. adjusting our heads

d. all of the above

9. In what region of the retina is vision the sharpest due to the largest concentration of cones?

a. fovea

b. optic nerve

c. saturation

d. where the optic nerve leaves the eye

10. Which of the following Gestalt laws is *correctly* defined?

a. Similarity—we tend to fill in small gaps in objects

b. Continuity—stimuli falling along the same plane tend to be grouped together

c. Figure Ground—stimuli near to one another tend to be grouped together

d. Closure—stimuli resembling one another tend to be grouped together

Fill-in-the-Blank

1. The sensory system that responds to pressure or damage to the skin is the _____ system.

2. The conversion of environmental stimuli into neural impulses is called _____.

3. The human tongue is covered with bumps called _____.

4. The olfactory bulb sends information to the _____, a brain area important for learning and memory.

5. Relative to the location of the stimulation, tactile information is processed on the _____ side of the brain; that is, it is processed _____.

6. The pain-relieving chemicals naturally produced by the nervous system belong to a class of substances called _____.

7. When we describe the "loudness" of a sound, we are referring to its _____.

8. _____ is a phenomenon in which one sensation may evoke multiple perceptions, including perceptions associated with different sensory systems.

9. Dilation and constriction of the _____ is one way that the visual system adapts to light.

10. The "what" visual pathway terminates in the _____ lobe; the "where" visual pathway terminates in the _____lobe.

CHAPTER 6
Consciousness

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CHAPTER OUTLINE

When We Are Awake: Conscious Awareness

LEARNING OBJECTIVE 1 Define different levels of conscious awareness and describe key brain structures and functions associated with those levels.

When We Are Awake: Preconscious and Unconscious States

LEARNING OBJECTIVE 2 Summarize the ideas of preconscious and unconscious states, including Freud's thinking on the unconscious.

When We Are Asleep

LEARNING OBJECTIVE 3 Describe sleep, key theories of why we sleep and dream, and problems with sleep and how they affect functioning.

Altered States of Consciousness: Hypnosis

LEARNING OBJECTIVE 4 Discuss theories and evidence about what hypnosis is, how it works, and how it can be used.

Altered States of Consciousness: Psychoactive Drugs

LEARNING OBJECTIVE 5 List and describe common depressant, stimulant, and hallucinogenic psychoactive drugs and their effects.

Have you met Eugene Goostman? Probably not face to face, but you might have had a chat session with him. Eugene is a 13-year-old Ukrainian boy. Eugene likes hamburgers and candy and his father works as a gynecologist. Eugene comes across as a normal, conscious, young boy. What is most interesting about Eugene, however, is that he passed the Turing Test—and that he is not a real conscious human. Eugene was a computer program. The

Turing Test was developed by Alan Turing in 1950 (Turing, 1950) as a means for determining when an artificial intelligence program had reached the point where it appeared to have human-like consciousness. The test is relatively simple: real humans interacted via teletype (chat these days) either with a real human or a program (they are not told which). After 5 minutes, they had to say whether they had been interacting with a human or a machine. Turing said that if a machine could fool 30 percent of the people who interact with it into thinking it was human and conscious, then it passed the test and we would deem it to be a genuine artificial intelligence form.

Eugene fooled just over 30 percent of the humans who chatted with him in a controlled series of tests at the University of Reading in England in June 2014. While it remains controversial to this day as to whether Eugene really passed the Turing test it raises many interesting questions about AI and what it means to be human. Recently, artificial intelligence researchers have moved away from the Turing test and toward what some call a Turing Olympics that assesses a broader definition of intelligence. One example of this was the Allen AI Science Challenge, which assessed the ability of artificial intelligence programs to solve Grade 8 multiple-choice science questions. Sounds too simple, perhaps, but it was a large step forward in evaluating artificial intelligence programs (Schoenick et al., 2016). In this chapter we will not consider the question of how Eugene's program "fakes", how we know if someone we chat with online is a conscious human being, if the actual version of the Turing Test he passed was valid (Mann, 2014; Masnick, 2014), or whether the Allen AI Science Challenge does a better job than the Turing test at spotting "genuine" artificial intelligence (We will return to AI in Chapter 10 on Intelligence.) Instead, the key psychological question we *will* consider in this chapter is what is human consciousness? How does consciousness work, what areas of the brain are necessary for it, and what happens to consciousness when we sleep? How can we manipulate it via hypnosis or psychoactive drugs? Within the field of psychology, interest in the nature and complexity of human consciousness goes back to the early work of psychologists, in particular that of William James, whom you met in Chapter 1, over 100 years ago, though human reflection on the nature of consciousness goes back much longer than that.

Consciousness is often defined as our immediate awareness of our internal and external states. But how aware is "aware"? Sometimes we are very aware of something, and other times only slightly so. Sometimes, we do not seem to be paying much attention to complex stimuli, yet we wind up recalling information about them later. Consciousness is one of the most intriguing—as well as one of the most mysterious—things that psychologists study.

consciousness our immediate awareness of our internal and external states.

Reflections on the nature of consciousness have been part of many spiritual traditions, such as Buddhism, going back many centuries (Harvey, 2012). The systematic, psychological, study of consciousness is more recent and has undergone many historical shifts. Early psychologists defined psychology entirely as the study of consciousness. William James, for example, noted that our conscious awareness continually shifts based on what we're paying attention to and how intensely we are attending to our environment (Schooler, 2011; Singer, 2003).

At the same time, we feel continuity from moment to moment. Many things we do

repeatedly, like driving, may require little of our conscious awareness. Yet if that changes because an animal jumps out on the road in front of us, we will turn more of our attention to the new situation and hopefully respond in a way that protects all parties involved. James coined the term "stream of consciousness" to signify how we experience our conscious life because consciousness, like a running stream, keeps flowing with time.

Partly in response to the difficulties of conducting research on elusive concepts, such as the inner working of the conscious mind, many researchers during the first half of the twentieth century—especially those in North America—shifted their interest from consciousness to observable behaviour. As you read in Chapter 1, they equated psychology with behaviourism (Moore, 2010; Baars, 2003). Theorists and researchers in Europe, however, continued to pay significant attention to consciousness, and even unconsciousness.

During the latter part of the twentieth century, with important developments in neuroscience and computer technology, consciousness reemerged as a topic of major interest in psychology (Irvine, 2013; Frith, 2003). With the help of neuroimaging techniques, investigators have been able to meaningfully explore the relationship between brain activity and various states of consciousness (Baars & Gage, 2010; Faivre, Arzi, Lunghi & Salomon, 2017). Indeed, a considerable body of research is now directed at the study of the neural control of conscious and non-conscious states (Aru et al., 2019; Maillé & Lynn, 2020; Mashour & Hudetz, 2018).

When We Are Awake: Conscious Awareness

LEARNING OBJECTIVE 1

Define different levels of conscious awareness and describe key brain structures and functions associated with those levels.

When we think of consciousness, we often think of it as aspects of our outer or inner worlds that we are currently attending to, or focusing our attention on. Consciousness, however, has several states. Typically, we think of consciousness as being awake and aware of the world around us (see photo). However, we also have **altered states of consciousness**. These include: being asleep, having a dream, hypnosis, meditation (see Chapter 15 for section on meditation) anaesthesia, and the effects of psychoactive drugs (Aru et al., 2019). We'll discuss these altered states of consciousness as we move through this chapter.

altered states of consciousness a change in a person's ability to be fully aware of their external surroundings and internal states.

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States of consciousness **Sleep, in contrast to being awake, is just one of several states of consciousness. Dreaming while sleeping is one of several altered states of consciousness.**

When it comes to conscious awareness, we can divide it into two components: **states of consciousness** (for example, being fully awake or asleep), and the **contents of consciousness** (for example, being aware of your dog, the itch between your shoulder blades, and your need to go to the bathroom). It is the combination of our states, and contents, of consciousness that make up our awareness of ourselves and the world around us. Currently, research in the area of consciousness tends to focus more on the study of states than contents of consciousness and researchers tend to focus primarily on studying one aspect or the other. Rarely are states and contents studied together. However, researchers are moving toward integrating these two aspects of consciousness in their studies (Bachmann & Hudetz, 2014).

states of consciousness the level of awareness we have of our external surroundings and internal states.

contents of consciousness specific thoughts we are aware of about our internal states or external surroundings.

When defining consciousness, we often assume that a person, or animal, needs to be awake to be conscious. Interestingly, there are times when being awake and being conscious can be dissociated from one another. For example, some individuals who have seizure disorders, or epilepsy, may appear awake but are not conscious of the world around them (Bayne, 2011; Berlucchi & Marzi, 2019). To begin our journey into the world of consciousness, we will focus on awake states and our awareness of the world around us. We will start with focusing our attention on attention and awareness, and how what we focus on impacts the conscious experiences we have of our environments. (See Psychology Around Us 6.1.)

Attention is a key part of our conscious awareness. The relationship between attention and

consciousness is the topic of lively debate in psychology. One possibility is that attention is a prerequisite for consciousness. Psychiatric researcher John Ratey (2001) has pointed out that "Before we can be conscious of something . . . we have to pay attention to it." At the same time, attention does not equal consciousness; we need something more. To be fully conscious of something, we must be *aware* that we are attending to it (Lewis, 2010). Inattention blindness, for example, refers to the consistent research finding that people who are not paying attention to a picture, video, or scene are unable to report on the details of what those visual stimuli contain (Chabris & Simons, 2010; Drew, Võ, & Wolfe, 2013; Seager, 2016).

In now classic work by Daniel Simons and colleagues, they showed that you can have a gorilla walk right through a video of people passing a ball and many people won't see it (Chabris, C. & Simons, D. J., 2010). This only occurs when you are asked to pay focused attention on another aspect of the video, like how many times the people in the white shirts pass a ball to each other. A YouTube search for "selective attention test" takes you to this well-known video. It may also be possible however, that some of our consciousness is not tied to our attention. If participants are shown a picture for a very brief interval (30 ms, or 30/1000 of a second) they are not able to report any of the details in that picture (no attention); however, they are able to report the *gist* (general or overall impression) of what was in the picture. So if it was an animal or nature scene as opposed to an abstract art image of a city scene, participants will be able say something general about it (e.g., it's a nature picture). This finding suggests that participants could actually be somewhat conscious of something they have not been able to focus attention on (Koch, Massimini, Boly, & Toni, 2016; Tononi and Koch, 2015). As we interact with our environment, we constantly monitor both ourselves and the situations at hand to help ensure that we attend to key features of the interactions (see photo).

6.1 Psychology Around Us

Multitasking: Myth or Reality?

The idea of multitasking in humans is somewhat of a myth, since very few people can actually multitask—that is, perform executive mental functions in parallel. Studies have shown that less than 2 percent of people can actually multitask without a degradation in IQ and output. Given that we know multitasking at best is available to just 2 percent of the population (Sanbonmatsu, Strayer, Medeiros-Ward, & Watson, 2013), what does that mean for the rest of us in today's world of computers, streaming services, and especially cellphones that are always pulling our attention away with emails, texts, videos, and pictures our friends share with us?

Studies have consistently shown that when students use their cellphones while doing homework or attending lectures, their abilities to engage in either task are significantly degraded (Chen & Yan, 2016). In addition, our limited ability to feign multitasking by switching between streams of thought quickly actually fades as we age, although some studies show that engaging in certain tasks and playing certain games while multitasking can improve performance even in those over the age of 60 (Abbott, 2013). Still, these benefits are limited and if you are one of the 98 percent who can't truly multitask, then you are ultimately cheating what could have been if you

were laser focused on just one task (Carrier, Rosen, Cheever, & Lim, 2015).

AndreyPopov/Getty Images

Multitasking **We often think we can manage to do several mental tasks at the same time however what our brain is really doing is switching quickly between tasks.**

By and large the best that most people can do is switch quickly between tasks to give the illusion of multitasking. However, their performance at each task never rises to the level it would be if they were just concentrating on one task and not switching between two or more tasks. Unfortunately, cellphones have a tendency to exacerbate the problem, reducing cognition and performance on tasks by constantly distracting our single streams of consciousness.

Conscious awareness of ourselves, our needs, and how to satisfy them has directly helped us in survival, contributing mightily to our evolutionary progress. To be conscious of our thirst, for example, is to understand that water is necessary to quench it, and to know that we may need to plan to get water even before we are thirsty. Clearly, conscious awareness involves many elements beyond attention.

TCD/Prod.DB/Alamy Stock Photo

No room for error **When performing a dangerous task, such as climbing a mountain, careful monitoring can take on life-and-death importance.**

When We Are Awake

Research has shown that when we are awake, most if not all of the neurons in our brains are constantly active. Despite popular claims made in movies like *Lucy* with Scarlett Johansson, we do not typically make use of only 10 percent of our brain—we use all of it. Of course, certain neurons become especially active when an individual is stimulated by particular objects or events, but even in the absence of such stimulation, neurons are still active at a steady, low level and are constantly communicating with other neurons (Hopkin, 2010; Ma et al., 2016).

Recall from Chapter 3 that neurons tend to work together in groups, or *networks*, and the stability of those networks is dependent on continued activity between groups of neurons (Gilson, Savin, & Zenke, 2015). For us to experience conscious awareness of something, such as a thought or a car accident on the road in front of us, many of our neural networks must become active simultaneously to process the scene in front of us. While one set of networks, for example our visual system, is enabling us to pay attention to the accident we are seeing, other biological systems must also be at work. These include systems that allow us to monitor our own stress response to seeing an accident, and still others to process into memory what we have seen.

When thinking about the brain and conscious processes, it is important to keep in mind that while there are brain areas that are critical for conscious thought and awareness, such as the various parts of the cortex, these brain areas do not work in isolation but are part of the global activity of the brain (Berlucchi & Marzi, 2019). The interactions between different structures within the brain are equally, or arguably even more, important for our conscious experience of a unified world. We don't often think about this but when you have an experience, such as walking into a restaurant and smelling freshly baked bread, our brains put together the visual and smell information into a unified experience of baking bread that we can attend to. These sensory experiences are amalgamated into a single,

meaningful experience. When it comes to how the nervous system creates these unified experiences of our senses, one question that researchers have concentrated on in the last decade is, "What are 'the minimal neural mechanisms jointly sufficient for any one specific conscious experience?," such as the experience of freshly baked bread (Koch, Massimini, Boly, & Tononi, 2016, p. 307). This question has interesting implications for us as a human species, but also for the animals that live with us on earth. If we argue, for example, that a cortex is a required component of the neural circuits that underlie consciousness, and we know that cats and dogs have a cortex, does this mean they are conscious as well? Are their conscious states, assuming they have them, the same or different from ours? Are babies, whose cortex is immature and poorly developed, conscious? Can earthworms, that don't have a cortex but rather a distributed neural network, have conscious experiences?

Scientists don't have the answers to all of these questions, but are working toward understanding which neural structures are most important for conscious experience and how these structures work together. Researchers are also trying to understand how the various structures of our brain communicate with one another to form neural networks that function in a coordinated fashion to allow for a "normal," versus disordered, experience of consciousness (Bayne & Carter, 2018). (An example of a disordered state of consciousness is schizophrenia, which we discuss in Chapter 15.) In the next section, we will look at the role of several brain structures that are important for creating our conscious experiences, including the hindbrain reticular formation, thalamus and hypothalamus, and cortex. We'll finish this section by discussing what we know about the development of consciousness in humans and the difficulties of studying consciousness in babies and young children.

The Reticular Formation

Before we can be aware and conscious of the world around us, we need to be awake. In now classic experiments from the 1940s and 1950s, Horace Winchell Magoun and colleagues (French, Von Amerongen, & Magoun, 1952; Moruzzi & Magoun, 1949) discovered that electrical stimulation of the brainstem, specifically a structure they named the reticular formation (see Chapter 3), could bring an animal out of a state of sleep into a state of alert arousal. Conversely, in cases where this structure is damaged, an animal can no longer maintain a state of wakefulness (French & Magoun, 1952). This work was extended to humans, with the findings that individuals with damage to the front portion of the reticular formation or after meningoencephalitis, an infection of the meninges that covers the brain and presumably interfered with the functions of the reticular formation, had prolonged loss of consciousness (French, 1952). Their groundbreaking research and conclusions have become the foundation for our understanding of consciousness and conversely the altered state of consciousness: sleep. Today we recognize damage to the reticular formation, and associated pontine structures in the hind brain, as one of the factors that may contribute to cases where individuals are in a "locked in," or paralyzed and in non-communicative state like a coma (Bayne, Hohwy, & Owen, 2017; Graham, Owen, Weijer, & Naci, 2018).

The Thalamus and Hypothalamus

After our brains wake up and become alert, information needs to be processed for how

important it is to us, and decisions about what we will focus our attention on need to be made. We might think of the networks of neurons in the brain as similar to the different train lines in a complicated subway system, like that of London, England. For trains to get from place to place on schedule without collision, a train conductor or a system manager (or even a whole group of them) must oversee the process. Researchers have nominated several brain areas as potential conductors, involved in routing messages along the proper neural network "subway lines" of our brains.

Two of the most prominent candidates are the hypothalamus and thalamus. Both of these structures receive input from the reticular formation and the hindbrain. The hypothalamus, via several sub areas, including the paraventricular and mammillary nuclei, relays the signals received from the hindbrain reticular formation to the cortex to maintain an awake and attentive state. Damage to the neurotransmitter systems of the hypothalamus, specifically the orexin system, can lead to disturbances of wakefulness such as narcolepsy, which we will return to in the upcoming section on sleep disorders (Zhao et al., 2019). The second area of the brain that is crucial for sending signals from the hindbrain to the forebrain or cortex for consciousness is the thalamus. Activation of loops of circuits between the thalamus, and the different sensory and motor areas of the cortex, is critical for us to be consciously aware of our surroundings. In some cases, a loss of parts of the thalamus, or these thalamocortical circuits, can lead to a lack of conscious awareness of specific parts of the body or our surrounding environments.

Investigators have observed that people actually lose all consciousness and enter a deep coma if their hypothalamus and thalamus are broadly damaged. If, however, the damage to the nuclei occurs in only one hemisphere, individuals lose awareness of only half of their bodies. They become unaware of all events that occur on one side of their visual field, for example, or unaware of all objects that touch one side of their body (Van der Werf, Witter, & Groenewegen, 2002; Berlucchi & Marzi, 2019; Seth, 2018; Stender, Laureys, & Gosseries, 2017). In short, the hypothalamus and thalamus both play important roles in conscious awareness.

The Cerebral Cortex

Evidence has accumulated that some areas of the brain are responsible for what gets to our attention, such as the thalamus, while other areas—particularly ones in the cerebral cortex—are in charge of one's awareness of the information the cortex receives from subcortical structures. Classic research by Oxford emeritus professor Lawrence Weiskrantz (2000, 2002, 2009), (Berlucchi & Marzi, 2019; LeDoux, Michel, and Lau, 2020; Sahraie et al., 2010; Tamietto & Morrone, 2016) on *blindsight* illustrate how this works in the visual realm.

Weiskrantz studied people whose primary visual areas in the cerebral cortex (**Figure 6.1**) had been destroyed, leaving them blind, so far as they were aware. When Weiskrantz presented such people with a spot of light on a screen and asked them to point to it, the individuals were totally unaware of the light and could not fulfill the request. Yet, when he told the same individuals to "just point anywhere," they typically pointed in the direction of the light. Similarly, these individuals could generally avoid chairs, tables, and other objects as they walked through a room, denying all the while that they were seeing anything at all. In short, the patients in Weiskrantz's studies could and did readily attend to visual objects, yet because the primary visual areas in their cerebral cortex had been destroyed, they were

unaware of those objects. Weiskrantz and others have concluded that the areas of the brain that help us *attend* to visual stimuli are different from the visual areas in the cerebral cortex that help us to be *aware* that we are attending to such stimuli (LeDoux, Michel, & Lau, 2020).

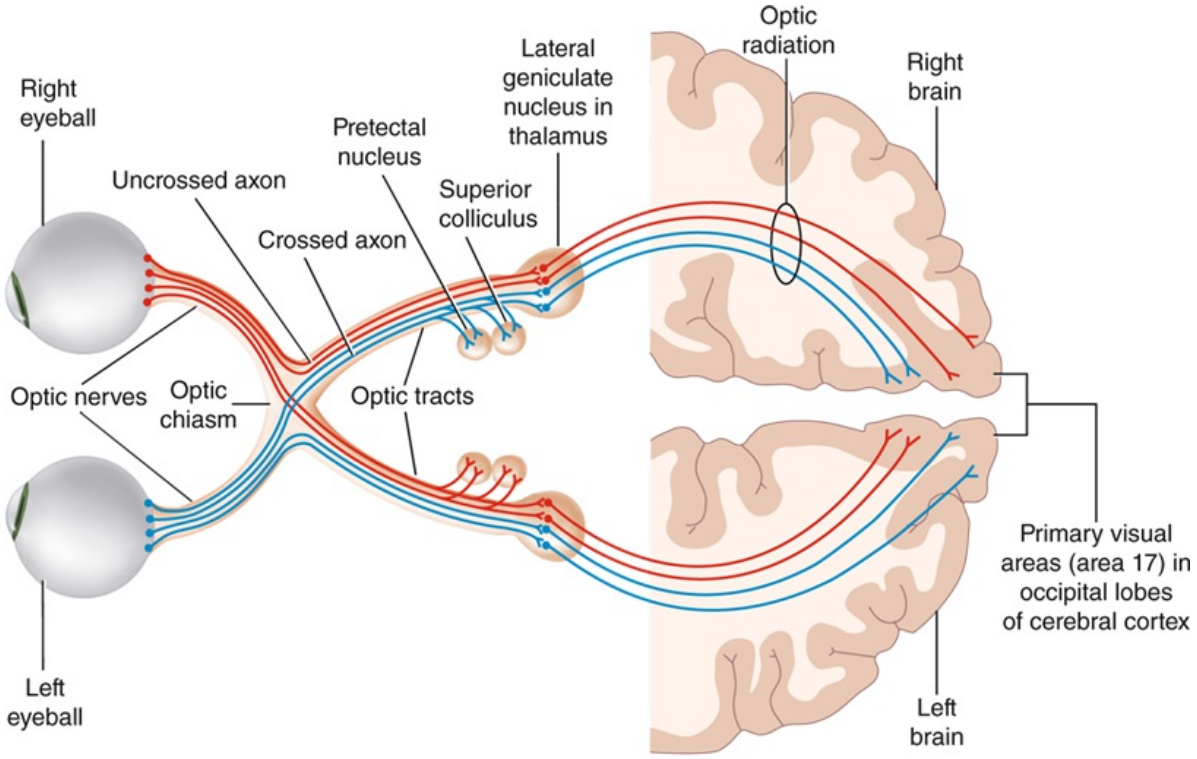

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FIGURE 6.1 Visual areas in the cerebral cortex We typically think of blindness as involving damage to, or malformation of, the retinas but they are really only one part of the visual perceptual process. Weisenkrantz's work on blindsight involves people with intact retinas but with damage to their primary visual cortex or, in rare cases, their superior colliculus. While they claim not to be able to see anything they can often provide correct responses to simple questions, about visual stimuli that has been presented to them, when asked to guess.

Recall the work by Sperry and Gazzaniga (Gazzaniga, 2018, 2010, 2005; Colvin & Gazzaniga, 2007; Sperry, 1998, 1982) discussed in Chapter 3 where patients who had their corpus collosum severed were briefly presented with an object or a word in their left or right visual fields. The investigators found that when they showed a word to a patient's left hemisphere, the individual was readily able to say and write the word. When a word was flashed to the right hemisphere, however, the individual could *not* name or write it. Apparently, the left cerebral cortex is responsible for verbal awareness and the ability to send a motor command to the mouth from Broca's area in order for the word to be spoken.

In contrast, the right cerebral cortex seems to be responsible for non-verbal forms of conscious awareness. In one study, for example, the experimenters flashed a picture of a screwdriver to the patient's right hemisphere. The individuals were then instructed to feel

a variety of real objects with their left hand from behind a screen, including a real screwdriver, and on the basis of touch to select the object that matched the picture they had just seen; all correctly selected a screwdriver. This suggests that the right cerebral cortex can produce tactile awareness, and perhaps other kinds of non-verbal awareness as well, but not verbal awareness. Of course, for most of us, our two hemispheres are connected, and these various kinds of awareness occur simultaneously, helping to produce a broad and complete sense of conscious awareness.

Advancements in imaging the activity of the brain have shown that the cortex is critical for the structure or contents of consciousness that we each experience. The synchronized activity of temporal, parietal, and visual cortex information from the environment is critical for us to be aware of an object, such as a cell phone, and to be able to verbalize the label for this object. For us to focus our awareness on our cell phone's activation, a network of connections between the frontal and parietal lobes is necessary with the frontal lobes playing a key role in deciding what we should focus on when we look at our phones: should we first check out the Snapchats we just received or the text from our significant other asking when we will be home? Thus, the control of our awareness is mediated by different areas and circuitry within the cortex itself (Nani et al., 2019).

Development and Consciousness

Researchers have made a number of attempts to identity consciousness in infants. As we saw in Chapter 4, there is evidence that even babies can direct their attention, hold concepts in mind, and engage in planned or intentional behaviours—the component skills of consciousness. Because babies are not yet able to talk very well, however, it's difficult to determine how aware they are that their experiences are things happening to them, of their own consciousness, or even whether they are fully aware of themselves as separate beings from others, a concept known as *sense of self*.

Researchers have developed some ingenious ways to try to determine when babies first experience a conscious sense of self. In one test, called the Rouge test, experimenters secretly dabbed red makeup on babies' noses while pretending to wipe them. Then they placed the babies in front of a mirror. The researchers reasoned that babies who had developed a sense or conscious awareness of self would see the makeup and touch their own noses, while those who did not understand they were looking themselves in the mirror would try to touch the makeup on the baby in the mirror (see the photo). Based on these classic experiments, it seems that most children develop a stable concept of the self by around 18 months of age (Lewis, 2010; Amsterdam, 1972; Gallup, 1970; Lewis & Brooks-Gunn, 1979). It also seems that apes, chimpanzees, some dolphins, and perhaps some elephants are capable of "passing" the rouge test (Turner, 2016).

Angela Georges/Moment/Getty Images

Hello there Does this baby know he is looking at himself in the mirror? We can test this by secretly putting red makeup on his nose and then watching how he reacts in front of the mirror. When babies look into a mirror and then touch their own nose because it is red, they show us that they are aware of themselves as separate beings from others.

Some researchers suggest that the early cognitive development we discussed in Chapter 4 and the development of consciousness contribute to one another. That is, if infants demonstrate the ability to develop concepts and to think through their behaviours even if they cannot express such thinking, they should be viewed as having a rudimentary sense of self-consciousness. Without this rudimentary sense of consciousness, babies would not be able to develop any concepts at all (Lewis, 2010).

Other theorists suggest that consciousness itself is rooted in language, representation, and social responsiveness. Because babies do not have language—the ability to let words represent events and experiences—they cannot reflect on their thoughts and behaviours and do not have full consciousness yet (Kristen-Antonow, Sodian, Perst, & Licata, 2015; Neuman & Nave, 2010). These theorists suggest that a shift happens at around 22 months of age (about the time they start to recognize themselves in the mirror on the Rouge test), when babies show the ability to reason inductively and to name and categorize concepts, which in turn enables them to represent concepts in a richer and deeper way.

Thus, describing how consciousness develops during awake states remains both a philosophical and empirical question, influenced in large part by how we define consciousness. The matter is further complicated by the question we asked at the beginning of this chapter: Just how aware is "aware"? We'll see next that there may be levels of alert consciousness at which we are not fully aware of all our thoughts.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

1. List the core cognitive processes of consciousness.

2. What is blindsight?

What Do You Think? • What characteristics do you believe are essential to define alert consciousness?

When We Are Awake: Preconscious and Unconscious States

LEARNING OBJECTIVE 2

Summarize the ideas of preconscious and unconscious states, including Freud's thinking on the unconscious.

Theorists often talk about different "levels of consciousness" or "degrees of consciousness" (Poznanski, Tuszynski, & Feinberg, 2017). Some also believe that consciousness should be distinguished from two alternative states, *preconsciousness* and *unconsciousness*.

Preconsciousness is a level of awareness in which information can become readily available to consciousness if necessary. Bringing to mind what you had for lunch last Tuesday might take a bit of work, but you should be able to pull the information out of your preconscious mind. When (or if) you finally do remember that bowl of soup, the memory has reached consciousness.

> **preconsciousness** level of awareness in which information can become readily available to consciousness if necessary.

Many of our most familiar behaviours occur during preconsciousness. Take a second—can you remember exactly what your morning ritual was this morning? What song was playing when you woke up? Did you count every tooth as you brushed it? Can you recall the details of every kilometre of your drive or ride to college or university today? For many morning activities, you probably do things in the same order, but you do not necessarily need to plan all the steps or think about what you're doing as you move through your ritual. Preconscious behaviours of this kind are sometimes called *automatic behaviours*. For example, driving can involve automatic behaviours.

An **unconscious state** (this is different than being unconscious when a person appears to be asleep and doesn't respond to external stimuli) is one in which information is not easily accessible to conscious awareness during an awake state. Perhaps you cannot remember the name of someone you saw from a distance, despite being sure you know them. Or you cannot call up the name of someone who bullied you in school when you saw a stranger who reminded you of that person. Unexpectedly, minutes or days later the name of the person or the song you could not recover earlier jumps right out of your memory into your conscious awareness. Psychoanalytic theorists, influenced by the ideas of Sigmund Freud,

would suggest that something triggered the release of the appropriate memory.

unconscious state state in which information is not easily accessible to conscious awareness.

Cognitive Views of the Unconscious

Throughout much of the twentieth century, scientists paid little, if any, attention to the unconscious. Rejecting Freud's psychoanalytic ideas (discussed a bit later), they also rejected the notion that people's behaviours, thoughts, and feelings may be influenced by mental forces of which they are totally unaware. This dismissal of the unconscious has shifted dramatically in recent decades. Today, most psychologists believe that unconscious (or automatic) functioning does occur and a number of explanations—particularly cognitive explanations—have been proposed (Semenza, 2017).

Perhaps the most prominent cognitive explanation for unconscious processing points to the concept of *implicit memory* (Manelis, Hanson, & Hanson, 2011, Kihlstrom, Dorfman, & Park, 2007; Kihlstrom, 2015a). As we shall describe more closely in Chapter 8, cognitive theorists distinguish between two basic kinds of memory: *explicit memory* and *implicit memory*. Explicit memories involve pieces of knowledge that we are fully aware of. Explicit memory is the conscious, intentional recovery of a memory. Knowing the date of your birth is an explicit memory. Implicit memories refer to knowledge that we are not typically aware of—information that we cannot recall at will, but that we use in the performance of various tasks in life.

Implicit memory is usually on display in the *skills* we acquire, such as reading, playing an instrument, driving a car, or speaking a second language. Our performance of such skills improves as we gain more and more of the knowledge, motor behaviours, and perceptual information required for the skills. These gains—that is, these implicit memories—are usually revealed to us indirectly by our improved performances, not by consciously recalling the acquired information and experiences that led to the improvements. Shortly after learning to drive, you may realize one day that you are able to drive and talk to a passenger at the same time but not recall the exact moment that you learned how to control the wheel and pedals well enough to add the activity of carrying on a conversation.

Implicit memory may also involve factual information. When we vote for a particular candidate on election day, a wealth of past experiences and information may be at the root of that behaviour, including childhood discussions with our parents about political parties, websites we have seen, articles we have read, political science classes we have taken, interviews or news stories we have read or heard, and more. As we mark an X on our ballot, however, we typically are not aware of all these past experiences or pieces of information.

Cognitive and cognitive neuroscience theorists see implicit memories as a part of everyday functioning, rather than as a way to keep unpleasant information from reaching our awareness (Bargh, 2017; Czigler & Winkler, 2010; Kihlstrom, 2015a). They have discovered research methods to test our unconscious—implicit—memories and have gathered evidence that explicit and implicit memories are stored in different pathways in the brain (Moscovitch, Cebeza, Winocur, & Nadel, 2016; Sheldon & Moscovitch, 2010).

kokotewan /Fotolia

In the line of duty **Fire chiefs must often make decisions quickly when arriving at a fire scene. Typically, they access the scene and make quick intuitive judgments about the course of action they should take. These judgments often rely on unconscious decision making.**

Many psychologists have begun to look at the benefits of "unconscious" decision making—quick, intuitive judgments. Early work by psychologist Gary Klein, for example, examined decision making in firefighters (see photo). Klein expected that, given the huge stakes involved in fighting fires, fire chiefs typically must consider a range of scenarios and carefully weigh the pros and cons before acting. What he found instead was that when fighting fires, fire chiefs typically identify one possible decision immediately, run the scenario in their head, and if it doesn't have any glaring errors, they go with it. Basically, the fire chiefs let their experience automatically generate a solution (Klein, 2004). Since Klein's work with firefighters, the role of intuitive processes in decision making has been studied in a wide range of occupations and situations where important, life-saving decisions are regularly made (Corbin, Reyna, Weldon, & Brainerd, 2015; Newell & Shanks, 2014). Ideas about the nature of consciousness were around long before cognitive psychology started to study them. Freud developed an interesting historical perspective on consciousness. While little data has been found that support his particular view, you can see that he was quite successful in getting us to think about the possibility that there is a LOT going on in our minds to which we do not have easy or simple access. (See Psychology Around Us 6.2.)

6.2 Psychology Around Us

Coma and Altered Consciousness

What part of the body is responsible for who we are? The answer—for anyone speaking, walking, and interacting with other people—is their brain. The brain is the centre of who we are: our experiences, our reactions, our sense of humour. Our abilities and memories all reside within our brain. There is a common trope in movies and television where someone who has been in a coma for a long time wakes up and is

entirely intact cognitively. While this has happened, it is extremely rare. Usually when a brain has been damaged to the point where the person is in a coma for an extended period, even if they do wake up, there are neurological consequences they have to deal with. One of these consequences can be an altered state of consciousness.

Adrian Owen at Western University in Ontario focuses on cognitive function in disorders of consciousness. If someone is in a coma (also known as a vegetative state), they are non-responsive to stimuli and are unable to communicate; it doesn't necessarily mean that they do not have preserved cognitive ability (Kelly, 2018). There are cases where, for example, an upper brain stem stroke can make a person appear to be vegetative when in fact their cognitive function remains entirely intact.

Tyler Olson/Shutterstock.com

Disorders of consciousness Patients who are in a coma, and on a ventilator, may still have brain activity in response to a naturalistic stimulus such as watching television.

Owen has studied disorders of consciousness such as coma using MRI and fMRI neuroimaging to peer into the mystery that these conditions create for medical professionals (Owen, 2020). Owen and his peers argue that there are better tools for assessing disorders of consciousness than are currently used in evaluating coma patients (Bayne, Hohwy, & Owen, 2017). In one study, Owen and his peers found that assessing brain function in individuals with altered consciousness, such as someone who can open their eyes but cannot speak or move their body, can be better assessed by examining brain activity using a naturalistic stimulus such as watching a movie or listening to an audiobook (Naci, Sinai, & Owen, 2017). Their findings suggest that we can differentiate between patient responses to spoken speech, meaningful sounds, and even the meaning of what's being spoken when we use neuroimaging tools to monitor brain activity in real time. Ultimately, much more work has to be done in this area, but the unfortunate situation of coma or vegetative state has helped researchers peer into the very essence of consciousness.

Freud's Views of the Unconscious

Although there are many current views about the unconscious, most have some relationship to the historic (not scientific) explanation advanced by Sigmund Freud (Gödde, 2010). As we discussed in Chapter 1, Freud believed that the vast majority of our personal knowledge is located in our unconsciousness, and thus is not readily accessible (see **Figure 6.2**). According to him, one of the key functions of unconsciousness is to house thoughts and memories too painful or disturbing for consciousness (Wilson, 2010). Indeed, Freud maintained that at some level, we may *repress* such thoughts and memories (of bullies we have known, for example), pushing them into our unconscious and preventing them from entering our conscious experience.

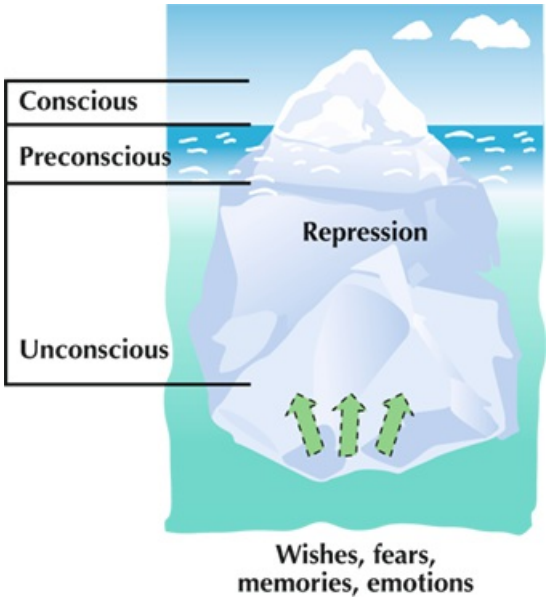


FIGURE 6.2 Freud's view of the unconscious **According to Freud, material that is relegated to the unconscious, such as repressed material, enters preconscious awareness or conscious awareness only accidentally or indirectly.**

Freud also suggested that, although it is typically inaccessible, unconscious material can enter conscious awareness (Johnson, 2016). Have you ever meant to say one thing, but something very different comes out, often to your embarrassment? Freud identified this slip of the tongue (called a *Freudian slip*) as a moment when the mind inadvertently allows a repressed idea into consciousness. Let's say that you do not enjoy your job but you're not sure why. One day you arrive at work 15 minutes late and your boss is waiting for you. Whereas you intend to say, "I'm sorry I'm late, boss," instead you say, "I'm sorry I hate boss." Suddenly you—and your boss—are well aware of why you don't like your job!

Freud also believed that our unconscious can work against us and that people who store too many emotionally-charged memories and needs in their unconscious may eventually develop psychological disorders. His theory suggests that the knowledge and memories stored in the unconscious maintain their ability to influence how we think, feel, and relate to others. If we repress too much, we may experience distortions in how we feel or relate to others, and, at the same time, we may feel helpless to change. Based on this part of Freud's theory, psychoanalytic psychotherapy attempts to bring patients' unconscious material into

their conscious awareness.

Freud's ideas about unconsciousness can be quite compelling. His ideas have been drawn into aspects of popular culture so that we often wonder what our motive is for not being able to remember something. The problem is that there is very little research data supporting most of Freud's views of the unconscious. This does not mean that all of our mental processes are conscious. Rather, it just means that the actual nature of unconscious processing is more complex than Freud envisioned (Bargh, 2017; Roffman, Gerber, & Glick, 2012).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

3. What is the difference between preconscious and unconscious states?

4. What is the importance of implicit memory in terms of the notion of the unconscious?

What Do You Think? • Do you think there are unconscious forces driving people's behaviours? If not, is it all conscious choice, or do you believe there are other explanations?

When We Are Asleep

LEARNING OBJECTIVE 3

Describe sleep, key theories of why we sleep and dream, and problems with sleep and how they affect functioning.

We could add a third item to Benjamin Franklin's famous comment that the only sure things in life are death and taxes: sooner or later we must—absolutely must—fall and stay asleep. Sleep is so central to our lives—indeed, most people spend approximately 25 years of their lives asleep—that we first need to ask, what important purpose does it serve?

Why Do We Sleep?

Interestingly, despite considerable research into the matter, no consensus exists about why people need to sleep (Krueger, Frank, Wisor, & Roy, 2016; Thakkar & Datta, 2010). After all, as we shall see, the brain does not rest when we are sleeping, nor, on the surface, does sleep offer the body much more rest than it would get by sitting down and relaxing for a while. Yet all animals, including we humans, sleep (though in different amounts) (see Figure 6.3), and would, in fact, suffer ill effects on our health, and have an increased risk of mortality, if we got either too little or too much sleep (Åkerstedt et al., 2017; Manoharan & Jothipriya, 2016).

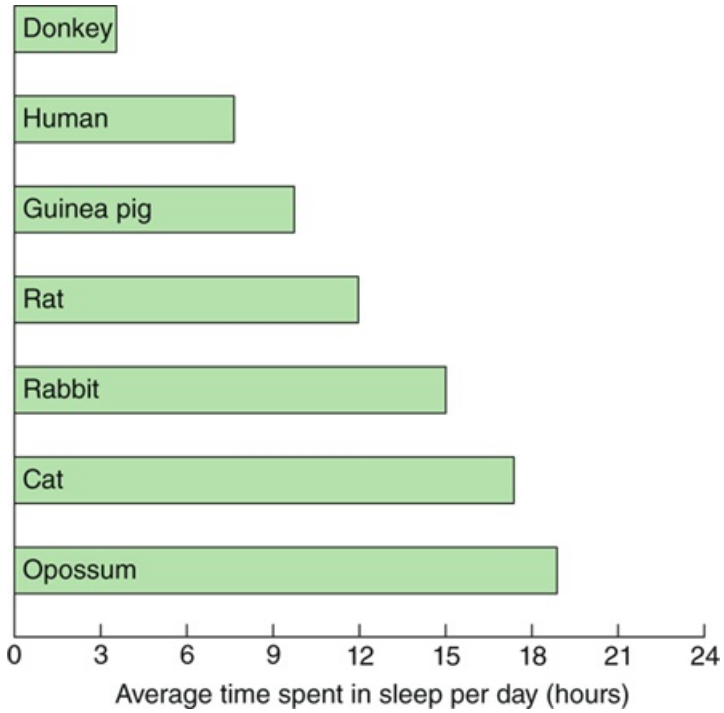


FIGURE 6.3 Sleep needs of various animals Animals vary greatly in how much sleep they need each day. Their sleep needs are related in part to how much awake time is needed to obtain food and protect themselves from predators (Siegel, 2005).

One theory, the **adaptive theory of sleep**, suggests that sleep is the evolutionary outcome of self-preservation (Field & Bonsall, 2016; Rial et al., 2010). Proponents of this view suggest that organisms sleep to keep themselves away from predators that are more active at night when our visual system, which is adapted for optimal use in daylight, does not provide us with much protection (Assefa, Diaz-Abad, Wickwire, & Scharf, 2015; Joiner, 2016). Our ancestors, for example, tucked themselves away in safe places to keep from being eaten by nocturnal animals on the prowl. Animals that need to graze, and so have less chance of hiding from predators, tend to sleep less. In a landmark study by J. M. Seigel (2005). it was shown that a giraffe, for example, sleeps only two hours, whereas a bat sleeps around 20 hours. This evolutionary argument certainly could account for why we sleep at night when it is dark, though one could easily argue it might actually be safer to stay awake if there are possible predators about. What it does not do is account for why people who are sleep deprived will sleep when given a chance regardless of whether it is day or night, and why people working night shifts seem to function well as long as they get enough sleep, regardless of whether they sleep at night or in the daytime. So perhaps there are other reasons for sleep, or for needing sleep (Keene & Duboue, 2018).

adaptive theory of sleep theory that organisms sleep for the purpose of self-preservation, to keep away from predators that are more active at night.

Several biological theories of sleep have also been proposed. One suggests that sleep plays a role in the growth process, a notion consistent with the finding that the *pituitary gland* releases growth hormones during sleep (Assefa et al., 2015; Garcia-Garcia et al., 2011). In

fact, as we age, we release fewer of these hormones, grow less, and sleep less.

Researchers have also observed changes in neuron activity in other areas of the brain during sleep, including the *reticular formation* and the *pons*, as well as the hypothalamus and *forebrain region*. As we described in Chapter 3, these regions are important in alertness and arousal. Underlying changes in the activity of these areas are changes in the activity of the neurotransmitter systems that run through all of these areas. For sleep to occur, inhibitory GABA signalling to the rest of the brain, from the hypothalamus, inhibits wake-promoting systems throughout the cortex (Brown et al., 2012). While researchers have made significant advances toward understanding how the brain causes sleep, there is still much to learn about how brain activity changes to allow us to sleep (Krause et al., 2017).

Another biological theory, the **restorative theory of sleep**, suggests that sleep allows the brain and body to restore certain depleted chemical resources, while eliminating chemical wastes that have accumulated during the waking day (Dworak et al., 2010; Xie et al., 2013). There is some evidence that supports this theory. In mice it has been found that neurotoxic waste products are removed from cells at a faster rate during sleep than when awake (Xie et al., 2013). Sleep deprivation also reduces the functioning of the immune system and has negative effects on cardiovascular health (Faraut, Boudjeltia, Vanhamme, & Kerkhofs, 2012). As well, growth hormone production increases during sleep in adults, a process that would also promote restoration of body tissues and structures (Leproult & Copinschi, 2015).

> **restorative theory of sleep** theory that we sleep to allow the brain and body to restore certain depleted chemical resources and eliminate chemical wastes that have accumulated during the waking day.

While we may not yet know exactly what causes sleep, we do know that sleep occurs in regular patterns, or *rhythms*, and that these rhythms reflect changes in the body's chemistry (Moorcroft, 2013).

Rhythms of Sleep

Human beings' basic activation pattern is called the **circadian rhythm** (see **Figure 6.4**). Within each 24-hour cycle, we experience a sustained period of wakefulness that gives way to a period of sleep. Although we tend to be awake during the day and to sleep at night, our circadian rhythms are not fully dependent on the cycles of daylight (Aubin, Kupers, Ptito, & Jennum, 2017; Cartwright, 2010).

> **circadian rhythm** pattern of sleep–wake cycles that in human beings roughly corresponds to periods of daylight and night.

During the circadian cycle, we also experience other, more subtle patterns of biochemical activity. As morning nears, for example, our temperature rises and continues to rise until it peaks at midday. Then it dips and we feel fatigued. Many people around the world take naps during this early afternoon lull. Later in the afternoon, body temperature rises once more, only to drop again as we approach our full evening sleep (Danovi, 2010). It seems that, on average, we are most alert during the late morning peak in the circadian rhythm.

This "rule," however, varies with age. Younger people tend to peak later in the day, while older people peak earlier (Chen, et al., 2016; Duffy, Zitting, & Choy, 2015).

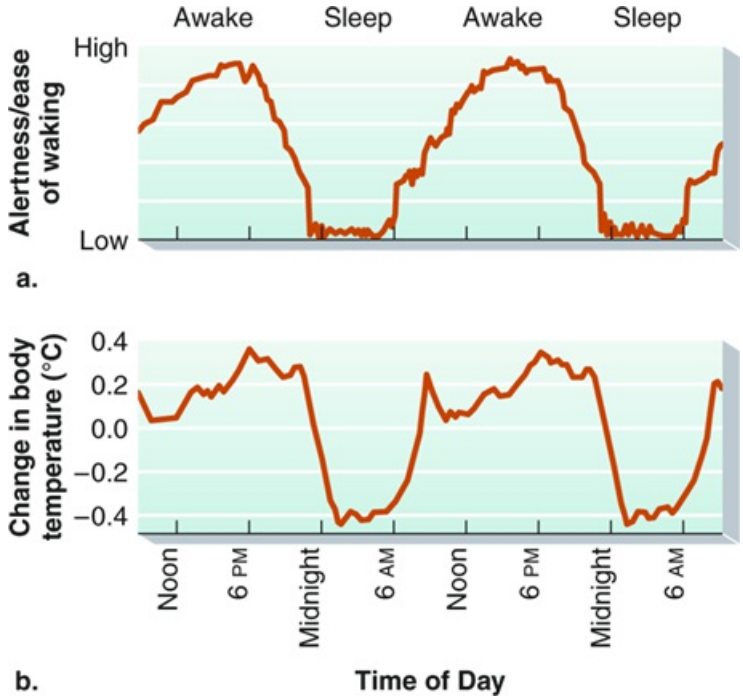


FIGURE 6.4 Circadian rhythms Two prime examples of circadian rhythms are our cycles of alertness and shifts in body temperature.

Along with shifts in body temperature, we also experience changes throughout the 24-hour period in blood pressure, the secretion of hormones, and sensitivity to pain. As we have discussed, for example, the release of growth hormones tends to occur during periods of sleep (Kim, Jeong, & Hong, 2015).

The circadian rhythm has been called our *biological clock* because the pattern repeats itself from one 24-hour period to the next. Certain events, however, can make this clock go haywire (Cartwright, 2010). For example, the clock can be disrupted by long-distance airplane flights when we are awake at times that we should be sleeping—a problem compounded by crossing time zones (Gander et al., 2016). The result: jet lag. Similarly, people who work nightshifts, particularly those who keep irregular schedules of dayshifts and nightshifts, may experience sleep disorders and, in some instances, develop problems such as depression or health difficulties (James, Honn, Gaddameedhi, & Van Dongen, 2017). People with a pattern called *circadian rhythm sleep disorder* experience excessive sleepiness or insomnia as a result of a mismatch between their own sleep–wake pattern (see Positive Psychology 6.1) and the sleep–wake schedule of most other people in their environment (Abbott, Reid, & Zee, 2015; Ivanenko & Johnson, 2010; Kim & Duffy, 2018).

"Owls" and "Larks"

Do you get up at the crack of dawn, head to the gym, and complete all of your class assignments before noon? Then you are probably a morning person (a "lark"). Or do you have trouble getting up before noon and can't really concentrate on your work until much

later in the day? If so, you are likely an evening person (an “owl”).

6.1 Psychology Around Us | Positive Psychology

Sleeping Your Way to Happiness

Increasingly, science tells us that proper sleep hygiene (habits and practices that are conducive to sleeping well regularly) is vitally important to our mental health and our overall happiness. A study of over 64,000 Japanese adolescents (Otsuka et al., 2020) found that subjective happiness, an individual’s self evaluation of their own happiness, was closely tied to the sleep habits of the study’s participants. In short, participants who slept better were subjectively happier than those who had poor sleeping habits. Another Japanese study using non-contact sleep sensors (Okamura et al., 2020) found that study participants who went to sleep quicker, slept deeper, and had lower heart rates during sleep had higher subjective happiness levels than those who slept poorly.

It turns out that emotional processing is particularly sensitive to sleep deprivation. In a study looking at participants’ ability to discriminate between 120 standard facial expressions representing emotional categories such as surprise, fear, sadness, and disgust, those with better sleep hygiene were superior at identifying facial cues (Killgore, Balkin, Yarnell, & Capaldi, 2020; Ong, Kim, Young, & Steptoe, 2017).

Ultimately, science tells us that proper sleep hygiene is critical in regulating our emotional responses, our mental health, and even our mental acuity. While young adults are historically famous for shunning sleep, it’s important to be aware of the possible consequences of sleep deprivation and to practise the best sleep hygiene possible.

Anton_Herrington/Getty Images

Getting a good night’s sleep **Good sleep habits are essential for our well-being and happiness and it may be true for other species as well, such as our furry companions.**

nullplus/Getty Images

STEEX/Getty Images

Sleep–wake rhythms **Researchers believe that genetics, rather than socio-economic factors—such as age, ethnicity, or gender—play a key role in determining variations in sleep–wake rhythms.**

Most people have no preference for the time of day when they are most alert and active; they may shift their sleep–wake rhythms two hours earlier or later than normal with no adverse effects on their alertness or activity level (Putiloy, 2017; Randler, Faßl, & Kalb, 2017). But for some, there is a strong preference for either earlier or later in the day.

Researchers now believe that genetics plays an important role in determining these variations in sleep–wake rhythms, with age, gender, and health factors also having an influence (Fischer, Lombardi, Marucci-Wellman, & Roenneberg, 2017; Kalmbach et al., 2017; Patterson et al., 2016). (See photos.) Every cell in your body has its own internal clock, governed by circadian clock genes, and scientists are able to measure your unique body clock at the cellular level (Takahashi, 2017). These clock genes govern a variety of functions within the body and can be altered by stress and nutrition and can influence a person's likelihood of developing a substance abuse disorder (Oike, 2017; Parekh, Ozburn, & McClung, 2015; Tahara, Aoyama, & Shibata, 2017). As we shall see, the master control centre for your body's internal clock and your own sleep–wake rhythm may be found in the brain area known as the *suprachiasmatic nucleus*.

When We Sleep

Research has uncovered what happens in our brains to control the circadian rhythms of when we wake and sleep, as well as what happens in the brain while we sleep.

Controlling the Clock

The **suprachiasmatic nucleus (SCN)**, a small group of neurons in the *hypothalamus*, is ultimately responsible for coordinating the many rhythms of the body (Hastings, Maywood, & Brancaccio, 2018) (**Figure 6.5**). As daylight fades into night, the SCN "notices" the change and directs the *pineal gland* to secrete the hormone *melatonin*. Increased quantities of melatonin, travelling through the blood to various organs, trigger sleepiness. Melatonin production peaks between 1:00 and 3:00 A.M. As dawn approaches, this production decreases and sleepers soon awaken. There is increasing evidence (Zisapel, 2018) that melatonin may reduce the severity of jet lag, likely by resetting the circadian clock.

suprachiasmatic nucleus (SCN) a small group of neurons in the hypothalamus responsible for coordinating the many rhythms of the body.

During the day, photoreceptors in the retina, which have their own internal clocks for sensitivity to light, of the eye communicate the presence of sunlight to the SCN and alter dopamine and melatonin signalling. Low melatonin levels during the day are part of the complex signalling system in the SCN that controls our sleep–wake patterns (Besharse & McMahon, 2016; Pfeffer, Korf, & Wicht, 2018). Photoreceptors are also sensitive to artificial light. In fact, the invention of the light bulb just over a hundred years ago has disturbed the human experience of the circadian rhythm by increasing the number of hours of light people are exposed to in a given day. This increased exposure to light has led to disruptions of our circadian rhythms and may have negative effects on our psychological and cardiovascular health (Cho et al., 2015).

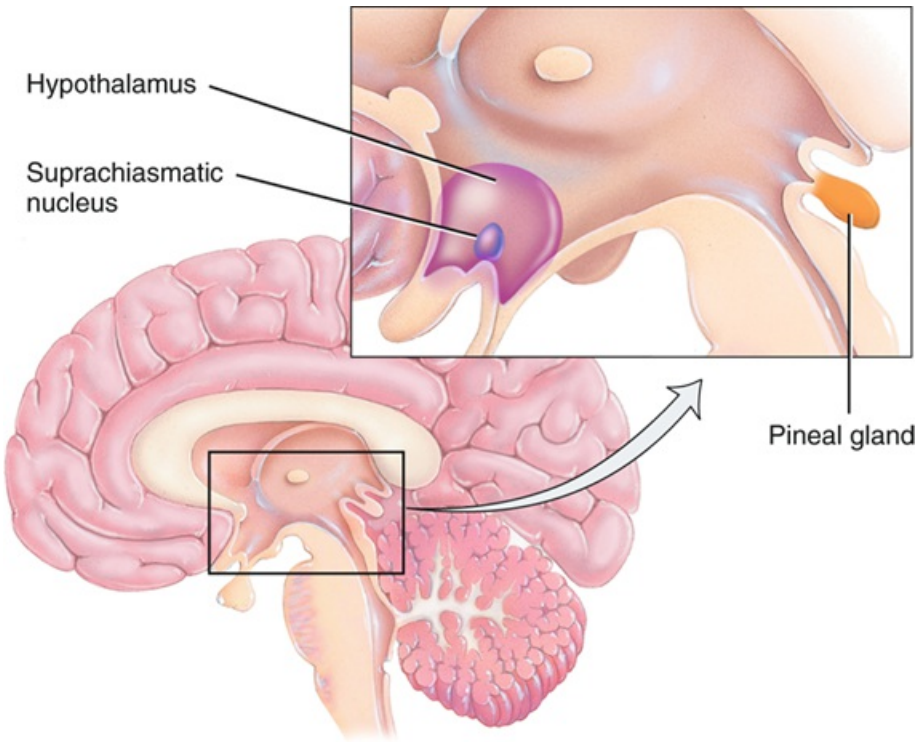


FIGURE 6.5 The suprachiasmatic nucleus (SCN) The SCN directs the *pineal gland* to secrete the hormone *melatonin*, which causes sleepiness. Synthetic versions of melatonin are sometimes taken to reduce the effects of jet lag.

What happens if a person is entirely deprived of access to environmental shifts in sunlight and darkness? In a number of sleep studies, participants have been placed in special settings where they are totally deprived of natural light and have no way to measure time. In such settings, the SCN can extend the body's "day" by as much as an hour, to about 25 hours (Bollinger & Schibler, 2014). When we are deprived of light, or are exposed to constant light, the various circadian rhythms also become out of sync with each other. The daily cycles of body temperature, release of stress horomones from the adrenal glands, and melatonin production, for example, are desynchronized with one another (Tapia-Osorio et

al., 2013; Kalsbeek et al., 2012).

If we speak of a biological clock, we should also be able to speak of *setting*, or *resetting*, the clock (Ramkisoensing & Meijer, 2015; Rohling et al., 2011). In fact, when a person who has been kept in an environment without sunlight is returned to normal living conditions, the usual 24-hour circadian rhythm is quickly restored. Maurizio Montalbini, a sociologist, spent a total of two years and eight months in underground caves to study the effect of isolation on the mind and the body. His first experiment with cave dwelling was in the 1980s and his final experiment was in 2006. He died of a heart attack at the age of 56 during this final experiment. (See photo.)

Patterns of Sleep

Every 90 to 100 minutes over the first half of the night while we sleep, we pass through a sleep cycle that consists of five different stages (Fedotchev, 2011). Over the latter part of the night, we tend to spend most time in the first two of these five stages and in rapid eye movement or REM sleep. Researchers have identified these stages by examining people's brainwave patterns while they sleep, using a device called an *electroencephalograph* (*EEG*). EEG readings indicate that each stage of sleep is characterized by a different brainwave pattern, as shown in **Figure 6.6**.

Eric VANDEVILLE/Getty Images

Studying circadian rhythms **Maurizio Montalbini spent months living in a cavern, with no external light or means of telling the time, to study the circadian rhythms free of external or artificial influences.**

When we first go to bed and, still awake, begin to relax, EEG readings show that we experience what are called *alpha waves*. As we settle into this drowsy pre-sleep period, called the **hypnagogic state**, we sometimes experience strange sensations. We may feel that we are falling or floating in space, we may "hear" our name called out, or we may hear a loud crash. All of these sensations seem very real, but none actually has happened. Such sensory phenomena are called *hypnagogic hallucinations* (Jones, Fernyhough, & Larol,

2010). Also common during this pre-sleep stage is a *myoclonic jerk*, a sharp muscular spasm that generally accompanies the hypnagogic hallucination of falling.

hypnagogic state a pre-sleep period often characterized by vivid sensory phenomena.

When we finally doze off, EEG readings show that our brainwaves become smaller and irregular, signalling that we have entered *Stage 1 sleep*. Alpha-wave patterns are replaced by slower waves, called *theta waves*. This first stage of sleep actually represents a bridge between wakefulness and sleep; it lasts only a few minutes. Our conscious awareness of street noises or the hum of an air conditioner fades. If we are roused from this stage, we might recall having just had ideas that seem nonsensical.

Falling deeper into sleep, we next pass into *Stage 2 sleep*. A still further slowing of brainwave activity occurs during this stage, although we may also exhibit **sleep spindles**—bursts of brain activity that last a second or two. During Stage 2, our breathing becomes steadily rhythmic. Occasionally the body twitches, although generally our muscle tension relaxes. During this stage, which lasts 15 to 20 minutes, we can still be awakened fairly easily. Toward the end of Stage 2 sleep, our brainwaves slow even further and *delta waves* start to appear in addition to the theta waves. Delta waves indicate *delta sleep*, or deep sleep.

sleep spindles bursts of brain activity lasting a second or two; occur during Stage 2 sleep.

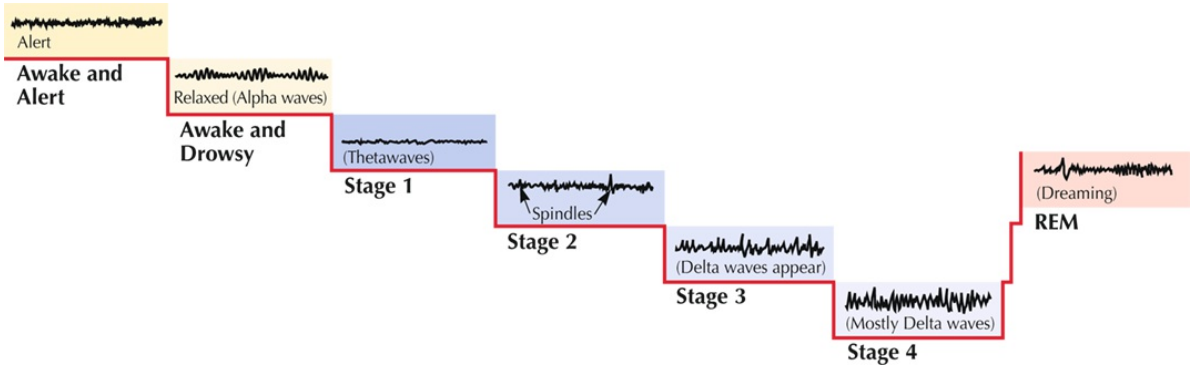


FIGURE 6.6 The stages of sleep As people move from an awake state to a state of deep sleep, their brainwaves become less and less frequent, and at the same time, larger and larger. REM sleep waves resemble alert-state brainwaves.

The next two stages of sleep, *Stage 3* and *Stage 4*, are characterized by very deep, slow wave, sleep. In Stage 3, between 20 and 50 percent of our EEG waves are delta waves. During Stage 4, heart rate, blood pressure, and breathing rates all drop to their lowest levels, and the sleeper seems cut off from the world. Although our muscles are most relaxed during this deepest phase of sleep, this is also the time when people are prone to sleepwalking. This is also the stage of sleep that changes most during adolescence. As the brain finishes maturing during this time, the amount of slow wave sleep declines to adult typical levels (Colrain & Baker, 2011).

Passing through all of the first four stages takes a little more than an hour of each of our first two 90-to-100-minute sleep cycles. After that, we experience the most interesting stage of sleep, **rapid eye movement**, or **REM**, **sleep**. In fact, all the preceding stages (Stages 1–4) are collectively called **non-REM sleep**, or **NREM**. A graduate student in physiology, Eugene Aserinsky, discovered REM sleep when he attached electronic leads to his 8-year-old son's head and eyelids to monitor his sleep and waking brainwaves. He found unexpected brainwave activity, suggesting his son "had woken up even though he hadn't" (Aserinsky, 1996). During REM sleep, we experience rapid and jagged brainwave patterns, in contrast to the slow waves of NREM sleep. REM sleep has been called *paradoxical sleep* because, even though the body remains deeply relaxed on the surface—almost paralyzed—we experience considerable activity internally (Scammell, Arrigoni, & Lipton, 2017; Thakkar & Datta, 2010). The rapid brainwave pattern of REM sleep is accompanied by increased heart rate and rapid and irregular breathing. Moreover, every 30 seconds or so, our eyes dart around rapidly behind our closed eyelids. Perhaps most interesting, during REM sleep people's brains behave just as they do when they are awake and active (Fraigne, Torontali, Snow, & Peever, 2015).

rapid eye movement sleep (REM) stage of sleep associated with rapid and jagged brainwave patterns, increased heart rate, rapid and irregular breathing, rapid eye movements, and dreaming.

non-REM sleep (NREM) Stages 1 through 4 of normal sleep pattern.

Along with this brain activity, the genitals become aroused during REM sleep. Indeed, except during nightmares, men usually experience erections and women vaginal lubrication and clitoral engorgement during REM sleep, even if the content of the dream is not sexual (Ruoff & Guilleminault, 2013; Schmidt, 2018). Men often retain their erections beyond the REM stage, explaining the occurrence of morning erections.

As we will discuss shortly, dreams usually occur throughout REM sleep (**Figure 6.7**). If people are awakened during this stage, they almost always report that they have been dreaming. Unlike the hypnagogic hallucinations of pre-sleep, which are often fleeting and isolated images, dreams tend to be emotional and are experienced in a story-like form. Dreams are less common during NREM sleep, and when they do happen, they do not have the narrative structure of REM dreams and as a result are less vivid or fantastic than REM dreams.

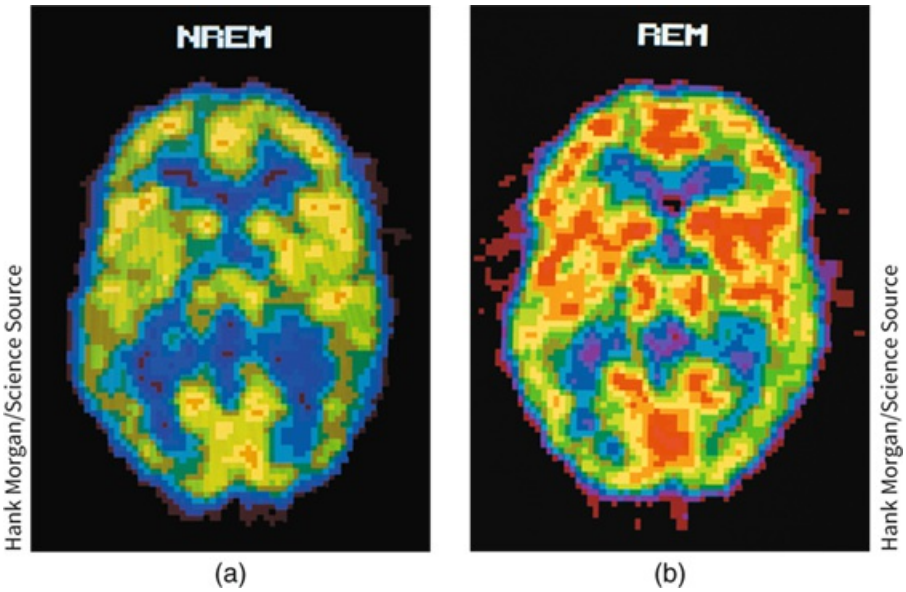


FIGURE 6.7 Almost like being awake When we are in REM sleep, our brains behave much like they do when we are awake and active, and indeed it is during this stage of sleep that we dream. The PET scan of a brain during REM sleep (left) reveals much more activity (indicated by the red and orange colours) than does the scan of a brain during non-REM sleep (right).

Many researchers believe that REM sleep serves a particularly important function—the consolidation of memories of newly learned material, a process that we will be talking about more in the coming chapters on learning and memory (Boyce, Glasgow, Williams, & Adamantidis, 2016; Rasch & Born, 2013; Diekelmann & Born, 2010). In fact, going into REM sleep improves learning of novel material in both animals and humans if the organisms go to sleep after just having learned the new information (Fogel, Smith, Higginson, & Beninger, 2011; Schönauer et al., 2017; Smith, 2006). In a classic study, a group of volunteers were trained on a perceptual task just before going to sleep (Karni et al., 1994). Half of the sleepers were awakened during REM sleep, while the other half were awakened later, during the next cycle of NREM sleep. The next day, those who had been awakened during REM sleep performed more poorly on the perceptual task than those who had been awakened during the later NREM phases. Presumably, the REM-awakened volunteers had not yet had the opportunity to fully consolidate their memories of the newly learned task.

It is worth noting that every kind of mammal whose sleep patterns have been studied, including birds, experience both NREM and REM sleep. Thus, many theorists believe that animals also dream. Of course, this comes as no surprise to dog owners who have, no doubt, observed their pets twitch their paws in a regular rhythm during REM sleep, as if running in a dream (Peever & Fuller, 2017). If you conduct a YouTube search for "BizKit the sleep walking dog" you will see an example of a dog that actually does much more than just twitch.

Dreams

Dreams—emotional, story-like sensory experiences that usually occur during REM sleep—have proven to be endlessly fascinating to scientists, clinicians, philosophers, artists, and

laypeople, probably because of their vividness and mysteriousness. Research suggests that actions in dreams run in real time—that is, it takes you as long to accomplish something in the dream as it would if you were performing the action while you were awake. A woman dreams of being punched in the stomach and doubling over in pain. In thinking about the dream the next day, she notices that she feels very vulnerable. She also recalls that earlier on the day of the dream, she had learned about a poor midterm mark and about an increase in the entrance GPA to a program she had planned to enter, and she remembers having felt vulnerable because her planned major is in jeopardy. Could the dream and the poor midterm grade be related? Some psychologists would say yes, while others would be skeptical (Duesbury, 2011). Dream content varies widely. Tore Nielsen at the University of Montreal has studied dreaming extensively and in a now-classic study asked introductory psychology students at his university about the contents of their dreams (Nielsen et al., 2003). The results are shown in **Table 6.1** so you can see how your typical dreams compare with those of other students. Looking at the dream content in Table 6.1 it is easy to see why we might assume there is life-relevant meaning in the content of our dreams. In this section we will examine ways in which different theorists and researchers have come to understand dreams (Cartwright, 2010; Moorcroft, 2013).

Information-Processing Theory

Information-processing theory offers a cognitive view of dreaming. According to this view, dreams are the mind's attempt to sort out and organize the day's experiences and to fix them in memory. Consistent with this perspective, studies have revealed that interrupting REM sleep—and so interrupting dreams—impedes a person's ability to remember material learned just before going to sleep (Schönauer et al., 2017). Also, in support of this view, researchers have found that periods of REM sleep (during which we dream) tend to extend longer when people's days have been filled with multiple stressful events or marked by extensive learning experiences (Fogel et al., 2011). Thus, according to an information-processing perspective, the student who dreamed of being punched may simply have been attempting to process and give order to the stressful academic challenges that she had experienced earlier in the day.

information-processing theory hypothesis that dreams are the mind's attempt to sort out and organize the day's experiences and to fix them in memory.

TABLE 6.1

Dream Themes

Adapted from Nielsen et al., 2003.

	Total Prevalence	Men Prevalence	Women Prevalence
chased or pursued, not physically injured	81.5	77.7	83.1
sexual experiences	76.5	85.0	73.0
falling	73.8	73.0	74.0

school, teachers, studying	67.1	56.9	71.3
arriving too late, e.g., missing a train	59.5	54.5	61.5
being on the verge of falling	57.7	53.4	59.5
trying again and again to do something	53.5	54.5	53.1
a person now alive as dead	54.1	43.1	58.6
flying or soaring through the air	48.3	58.1	44.4
vividly sensing . . .a presence in the room	48.3	44.3	49.9
failing an examination	45.0	37.2	48.1
physically attacked (beaten, stabbed, raped)	42.4	39.9	43.5
being frozen with fright	40.7	32.3	44.2
a person now dead as alive	38.4	36.7	39.0
being a child again	36.7	33.1	38.2
being killed	34.5	35.8	34.0
insects or spiders	33.8	25.5	37.1
swimming	34.3	29.0	36.4
being nude	32.6	37.5	30.6
being inappropriately dressed	32.5	30.8	33.2
discovering a new room at home	32.3	30.8	33.0
losing control of a vehicle	32.0	29.3	33.1
eating delicious foods	30.7	28.7	31.4
being half awake and paralyzed in bed	27.2	25.2	28.0
finding money	25.7	34.0	22.3
fire	27.3	22.6	29.3
having magical powers (other than flying. . .)	24.9	39.3	19.0
having superior knowledge or mental ability	24.4	36.4	19.5
being smothered, unable to breathe	24.2	21.1	25.5
killing someone	24.3	36.1	19.5

In response to the question "Have you ever dreamed of. . . ." with a list of commonly-reported dream themes, this table shows the percentages of students who reported having had a dream of each of the types listed.

Activation-Synthesis Hypothesis

Researchers J. Allan Hobson and Robert McCarley have proposed a more biological hypothesis about dreaming, the **activation-synthesis model** (Hobson, 2005, 2009; Hobson

& McCarley, 1977) (see **Figure 6.8**). They argue that as people sleep, their brains activate all kinds of signals. In particular, when dreams occur, neurons in the *brainstem* are activated. These, in turn, activate neurons in the *cerebral cortex* to produce visual and auditory signals. Also active are areas of the brain involved in emotion and arousal, including the *cingulate cortex*, *amygdala*, and *hippocampus*. Neuroimaging scans of people who are experiencing REM sleep confirm heightened activity and neuron communication in each of these brain regions.

> **activation-synthesis model** theory that dreams result from the brain's attempts to synthesize or organize random internally-generated signals and give them meaning.

Hobson and McCarley suggest that the activated brain combines—or *synthesizes*—these internally-generated signals and tries to give them meaning. Each person organizes and synthesizes this random collection of images, feelings, memories, and thoughts in his own personal way—in the form of a particular dream story (Hobson et al., 1998, 2003, 2011; Zielinski, McKenna, & McCarley, 2016). Someone who dreams of being punched in the stomach might be trying to synthesize activation in brain areas that normally receive signals from the muscles of the stomach with signals from areas of the brain that process emotions, for example.

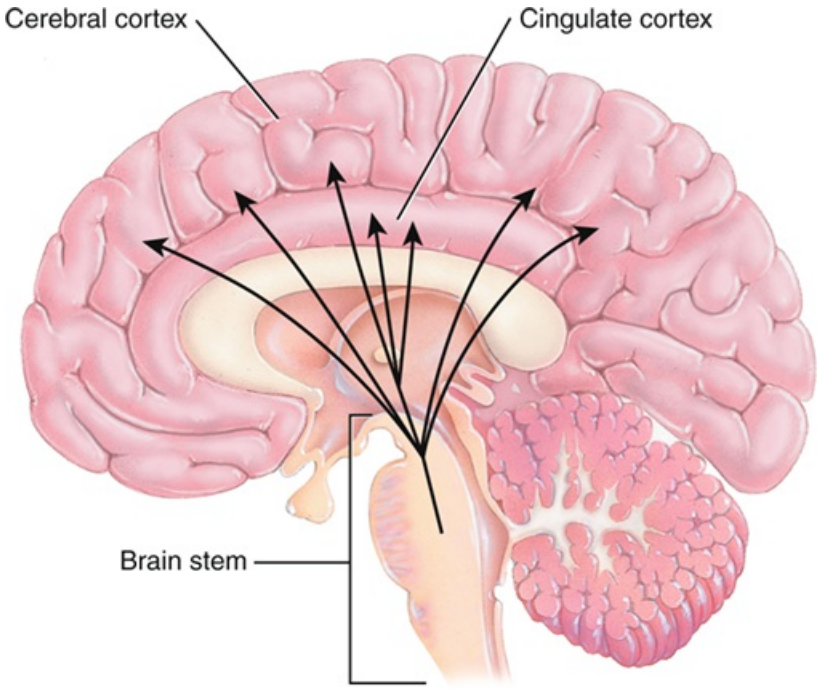


FIGURE 6.8 Activation-synthesis According to the activation-synthesis theory of dreaming, neurons in the brainstem activate neurons in other areas throughout the brain. The brain combines these various signals into a story, or dream.

What remains unclear in this model is why different people synthesize their onslaught of brain signals in different ways. Freud, of course, might suggest that each person's particular synthesis is influenced by her unfulfilled needs and unresolved conflicts.

Freudian Dream Theory

Sigmund Freud argued that dreams represent the expression of unconscious wishes or desires. He believed that dreams allow us to discharge internal energy associated with unacceptable feelings (Freud, 1900). Freud suggested that *dream interpretation*, in which a psychoanalytic therapist facilitates insight into the possible meaning behind a dream, may help clients appreciate their underlying needs and conflicts with the goal of being less constrained by them during waking life. For example, if a lonely and morally upstanding young man is sexually attracted to his brother's wife but is not consciously aware of this desire, he might have a dream in which he goes swimming in a private pool that is marked "No Trespassing." His therapist might help the man arrive at the conclusion that the dream about swimming in an off-limits pool symbolizes his wish to be with his sister-in-law. Such an insight eventually might help the man to overcome inhibitions he feels about finding a suitable partner for himself.

Freud called the dream images that people are able to recall the *manifest content of the dream*. The unconscious elements of dreams are called the *latent content*. In our example, the young man's desire for his sister-in-law (latent content)—a scandalous idea that he would never allow himself to have—is symbolized in the dream by a swim in the pool (manifest content). His dream of a happy swim in forbidden territory is his mind's solution to a problem that he could not work out consciously.

Many of today's theorists, including a number of psychoanalytic ones, criticize Freud's theory both in terms of its focus and its lack of verifiability through research. For example, *object-relations theorists*, psychoanalytic theorists who place greater emphasis on the role of relationships in development, focus more on relationship issues when interpreting dream material (Wolman, 1979). Regarding the earlier dream in which a student gets punched, an object-relations therapist might be inclined to help the patient explore her feelings of vulnerability in various parts of her life, rather than her educational fears.

Despite the lack of verifiability of Freud's theory of dreaming, there are signs that the cognitive approach to dreams that we discussed earlier could support bits of Freud's theory. Specifically, Dan Wegner asked participants in his studies to either think about something (such as a white bear) or to not think about the same thing while doing a writing task before going to bed. When they reported on the contents of their dreams, the participants who were told not to think about white bears dreamed a lot more about white bears than did those participants who were asked to think about them. When the forces of conscious thought suppression were relaxed as they slept, thoughts of white bears escaped much as Freud hypothesized (Imhof & Schulte-Jakubowski, 2015; Wenzlaff & Wegner, 2000).

Nightmares, Lucid Dreams, and Daydreams

Dreams evoke many different feelings. Dreams filled with intense anxiety are called *nightmares*. The feeling of terror can be so great that the dreamer awakens from the dream, often crying out. Nightmares generally evoke feelings of helplessness or powerlessness, usually in situations of great danger. They tend to be more common among people who are under stress. People who experience frequent nightmares and become very distressed by their nightmares are considered to have a *nightmare* or *dream anxiety disorder.*

It appears that nightmares are more common among children than adults, although there is some dispute on this issue (Paiva, 2017). Frequent nightmares in children have been associated with hyperactivity, mood disturbances, and poor academic performance (Li et al., 2011). Children that have a diagnosis of generalized anxiety disorder are also more likely to report having nightmares (Reynolds & Alfano, 2016). When children have a nightmare, simple reassurances that they are safe and that the dream does not reflect real danger are usually helpful. Cognitive interventions such as imagery rehearsal therapy, where an imagination of a new scenario rather than the nightmare imagery is practised, is one strategy that may be helpful for reducing nightmares in children (Schredl, 2018; Thünker & Pietrowsky, 2012).

In contrast to dreams and nightmares, during which dreamers feel they are caught in a real situation, **lucid dreams** are dreams in which people fully recognize that they are dreaming (Blagrove, Bell, & Wilkinson, 2010). Some lucid dreamers can even willfully guide the outcome of their dreams (Saunders, Roe, Smith, & Clegg, 2016; Voss et al., 2013). In a lucid dream, the woman who dreamed of being punched might tell herself—while still asleep—that she is only dreaming and is actually fine; she even might try to guide the outcome of the dream so that she prevails over her attacker. Although not necessarily subscribing to psychoanalytic theory, people who attempt to engage in lucid dreaming often believe that it is a way to open up another phase of human consciousness and perhaps help us to understand the relationships among frontal lobe function, rationality, and psychosis (Mota-Rolim & Araujo, 2013).

> **lucid dreams** dreams in which sleepers fully recognize that they are dreaming, and occasionally actively guide the outcome of the dream.

A third dream-related phenomenon is actually associated with waking states of consciousness—the daydream. Fantasies that occur while one is awake and mindful of external reality, but not fully conscious, are called *daydreams* (Delaney, Sahakyan, Kelly, & Zimmerman, 2010; Carr & Nielsen, 2015). During daydreams, high levels of emotional intensity, bizarreness, and altered sensory experiences have been reported (Carr & Nielsen, 2015). Sometimes a daydream can become so strong that we lose track of external reality for a brief while. Work-related daydreams may be a way to process possible career pathways and how personal goals can be integrated into desired work outcomes (Pisarik, Rowell, & Currie, 2012). Daydream experiences may also afford us opportunities for creativity; we are, after all, less constrained during the fantasies than we would be if attending strictly to the outside world.

Sleep Pattern Changes Over Development

Parents or older siblings know all too well that young babies do not sleep quite like older children or adults. Through the first four months of life, babies sleep between 14 and 17 hours each day. The amount of time that they spend sleeping declines steadily as they get older (Grigg-Damberger, 2017; Blumberg & Seelke, 2010). Although babies spend a lot of time asleep overall, the lengths of their sleep periods can last anywhere from minutes to hours before they are awake and crying out for attention. For parents, the good news is that sleep tends to become more structured at around 6 months of age (McLaughlin & Williams,

2009).

Babies appear to spend a great deal more time than adults in REM sleep—around eight hours per day for infants, compared with two hours for adults (Grigg-Damberger, 2017; Sankupellay et al., 2011; Joiner, 2016). The size of this difference has led theorists to suspect that infant sleep patterns are crucial to development in various ways. Several have speculated, for example, that REM sleep aids in the development of the central nervous system via activation of neuromuscular pathways and aids sensorimotor development. Recent research has shown that muscle twitches during REM sleep activate hippocampal and cerebellar pathways; these same areas are not activated by motor behaviour during wakefulness (Blumberg, Coleman, Gerth, & McMurray, 2013; Peever & Fuller, 2017; Sokoloff, Uitermarkt, & Blumberg, 2015). REM sleep tends to decrease to adult levels somewhere between the ages of 2 and 6 years (Bathory & Tomopoulus, 2017; El-Sheikh, 2011).

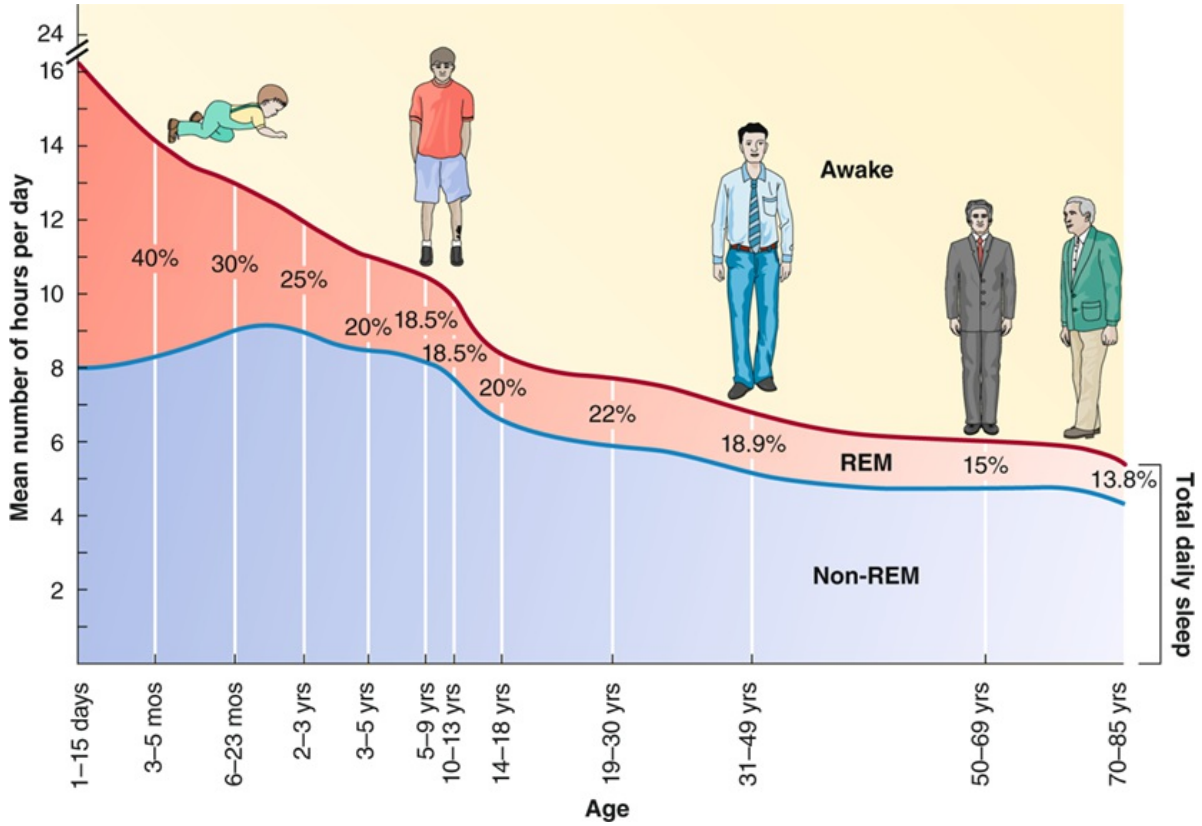


FIGURE 6.9 The effects of aging on the sleep cycle As we get older, our total daily sleep and our REM sleep decrease. The largest shifts occur during our first three years of life.

By early childhood, an individual's total daily sleep requirement also decreases significantly (see Figure 6.9). Most children sleep around nine hours each day, although pediatricians recommend between 12 and 15 hours of sleep for anyone between 2 and 5 years of age. Teenagers average around seven hours of daily sleep. Many adolescents stay up to catch up on homework, chat with friends on social media, or browse the Internet. These behaviours often lead to a lack of sleep for many teenagers (Singh & Kenney, 2013).

Poor sleep patterns, or inadequate sleep, during adolescence has been associated with poorer physical and psychological health, school performance, and increased risk-taking behaviour (Shochat, Cohen-Zion, & Tzischinsky, 2014). It is recommended that teenagers get a minimum of eight to nine hours of sleep a night (Crisp, 2015). As adults, our sleep patterns continue to change. As we age, we spend less and less time in deep sleep and REM sleep, our sleep is more readily interrupted, and we take longer to get back to sleep when awakened (Bliwise, 2010). It is estimated at that as many as 50 percent of older adults have challenges falling, or staying, asleep. Reasons for this can include physical factors such as increased aches and pains. Lack of good sleep in adulthood may be related to psychological disorders such as dementia and depression (Crowley, 2011). Restorative sleep at all ages is essential for physical and psychological health. We'll return in more detail to sleep deprivation in the next section.

As discussed earlier, our sleep–awake cycle is tied to our body's circadian rhythms. These biological clocks are also affected by environmental demands and expectations (Worthman, 2011). Studies have, for example, contrasted parenting practices in North America with those in the Kipsigis tribe (you may remember them from Chapter 4). Many Western parents structure their babies' sleep by putting them down at designated times and not responding to their cries. In contrast, Kipsigis mothers keep their babies with them constantly. As a result, Kipsigis babies sleep for much shorter periods of time later into infancy than do American babies; in many cases, they do not sleep for long stretches even as adults (Super & Harkness, 1972, 2002).

Sleep Deprivation and Sleep Disorders

As discussed in the previous section, how much sleep a person needs varies, depending on factors such as age, lifestyle, and genetic disposition. The amount of sleep people actually get may also be different from how much they need. Lifestyle deprives many people of sleep, and sleep disorders may also make it impossible to sleep properly.

Sleep Deprivation

Left unhindered, most people would sleep for nine or ten hours a day to awaken alert and refreshed. However, most of us have had the opposite experience—that of not getting enough sleep. When lack of sleep happens, we become generally sleepy and maybe a little cranky. After a while, we may yearn for sleep.

Researchers have found that without enough sleep, people also experience a general depressed state, and in turn, depression can lead to a disruption in sleep (Orzel-Gryglewska, 2010; Roberts & Duong, 2014). Individuals who are sleep deprived have lower productivity and are more apt to make mistakes, which has been documented in many industrialized countries, including Canada, the United States, Japan, United Kingdom, and Germany (Hafner et al., 2017; Gunzelmann et al., 2011). Stan Coren, a researcher at the University of British Columbia, has shown that accidents and deaths are more likely to occur when drivers and pilots do not get enough sleep (Coren, 1997). More recently, Rudin-Brown, Harris, and Rosberg (2019) have shown that sleep-related fatigue was a factor in 18 different cases of railway accidents in Canada. If we want to function coherently and safely, we all need to get enough sleep. While it is possible to make up for the lost sleep of one night by sleeping a little longer the next night, it becomes increasingly difficult for people to

"pay off" their "sleep debt" if they chronically miss sleep (Moorcroft, 2013).

As mentioned in the preceding section, adolescents are particularly likely to be sleep deprived (Wolfson & Richards, 2011). Teenagers today get about two hours less sleep per night than teens did 80 years ago. In fact, a distinguished pioneer in sleep research, William Dement, has asserted that 80 percent of students at his institution, Stanford University, are "dangerously sleep deprived". This seems to be especially true in college athletes (Dement & Vaughan, 1999; Mah, Kerizan, Marcello, & Dement, 2018).

Ironically, students who pull all-nighters to complete their work actually wind up working less efficiently and effectively than they would if they were to sleep the eight or nine hours that they need. Nancy Galambos and her colleagues at the University of Alberta (Galambos et al., 2013; Galambos, Dalton, & Maggs, 2009; Galambos, Howard, & Maggs, 2011) study the effects of chronic sleep deprivation in university students. Galambos's research involved having first-year students keep detailed logs of their daytime activities and their nighttime sleep-related behaviour over a two-week period. When they compared sleep activities to measures of general functioning, they found that getting less sleep led to more negative affect, spending less time on school work, and more socializing, other researchers have found evidence to support her conclusions (Chen & Chen, 2019; Royette & Willoughby, 2014). Better quality of sleep led to less negative affect, less stress, and less time spent on school work (perhaps because the time spent studying was more efficient when the students were better rested). This research suggests there is significant value in terms of student quality of life to be gained by paying attention to both the quantity and quality of sleep you are getting during the school term.

Sleep researchers used to spend most of their time examining the impact of lost sleep on simple or monotonous tasks. Today's researchers, however, often look at the impact of sleep deprivation on more complex activities, such as impulsivity, ability to discriminate social threats, and risk-taking (Anderson & Platten, 2011; Golstein-Pierarski, Greer, Saletin, & Walker, 2015; Womack, Hook, Reyna, & Ramos, 2013). Studies suggest that, on one hand, sleep deprivation does *not* necessarily lower one's performance on complex logical tasks. Sleep-deprived participants in such tasks often are able to avoid poor performances by being highly interested in the complex tasks at hand. Many sleep-deprived college and university students, for example, seem able to conduct research or write papers, particularly if these tasks interest them a lot.

Problems arise, on the other hand, when a sleep-deprived person faces unexpected turns of events, distractions, or innovations while working on a complex task, or needs to revise the task. If, for example, someone turns on the television while you're studying in a sleep-deprived state, your learning is likely to suffer considerably.

In an important set of findings, researchers have also learned that sleep loss can lower the effectiveness of people's immune systems, affect cardiovascular health, and impact metabolic disorders such as diabetes and obesity (Bollinger, Osta, & Solbach, 2010; Cappuccio & Miller, 2017; Irwin, Olmstead, & Carroll, 2016; Tobaldini et al., 2017). Sleep-deprived people apparently have a more difficult time fighting off viral infections such as the common cold and cancer, for example (Phipps et al., 2016; Prather, Janicki-Deverts, Hall, & Cohen, 2015). Thus, it may not be surprising that people tend to be healthier, less stressed, and perform better on cognitive-related tasks with adequate amounts of sleep

(Santhi et al., 2016; Scullin & Bliwise, 2015).

Sleep Disorders

Sleep disorders occur when normal sleep patterns are disturbed, causing impaired daytime functioning and feelings of distress. In the third edition of the International Classification of Sleep Disorders, by the American Academy of Sleep Medicine, seven major categories have been defined: insomnia, sleep-related breathing disorders, central disorders of hypersomnolence (too much sleep), circadian rhythm sleep-wake disorders, sleep-related movement disorders, parasomnias, and other sleep disorders (Ivanenko & Johnson, 2010; Sateia, 2014; Thorpy, 2012). Almost everyone suffers from some kind of sleep disorder at one time or another in their lives. The sleep disorder may be part of a larger problem, such as life stress, a medical condition, or substance misuse, or it may be a *primary* sleep disorder in which sleep difficulties are the central problem. Primary sleep disorders typically arise from abnormalities in people's circadian rhythms and sleep–wake mechanisms.

Insomnia

People who suffer from **insomnia**, the most common sleep disorder, regularly cannot fall asleep or stay asleep (Bastien, 2011; Horne, 2010). According to a large study by Charles Morin and his colleagues at Laval University, 20 percent of Canadians are dissatisfied with the quality of their sleep (Morin et al., 2011). The telephone survey further found that 40 percent of Canadian adults experience symptoms of insomnia at least three nights each week.

> **insomnia** sleep disorder characterized by a regular inability to fall asleep or stay asleep.

As you might expect, many cases of insomnia are triggered by day-to-day stressors. In particular, job or school pressures, troubled relationships, and financial problems have been implicated. For many people, a subtle additional stress is worrying about not getting enough sleep while trying to fall asleep. This vicious cycle can further intensify anxiety and make sleep all the more elusive (Jansson-Frojmark et al., 2011; Pillai, Roth, Mullins, & Drake, 2014).

Insomnia is more common among older people than younger ones (Jaussent et al., 2011; Abad & Guilleminault, 2018). Elderly individuals are particularly prone to this problem because so many of them have medical ailments, experience pain, take medications, or grapple with depression and anxiety—each a known contributor to insomnia (Suzuki, Miyamoto, & Hirata, 2017). In addition, some of the normal age-related sleep changes we described earlier may heighten the chances of insomnia among elderly people. As individuals age, for example, they naturally spend less time in deep sleep and their sleep is more readily interrupted (Bliwise, 2010). Insomnia in the elderly is a concern since it is correlated with increases in cardiovascular disease and dementia as we age (de Almondes, Costa, Malloy-Diniz, & Diniz, 2016; Nakazaki et al., 2012).

Sleep-Related Breathing Disorders

Fifty-four percent of married Canadians say their partners snore while sleeping. Of those, 63 percent say their partner's snoring keeps them awake at night and adds to their own fatigue (Nutravite, 2006). It is likely that many of these serious snorers suffer from **sleep apnea**, the second most common sleep disorder. People with this condition repeatedly stop breathing during the night, depriving the brain of oxygen and leading to frequent awakenings. Sleep apnea can result when the brain fails to send a "breathe signal" to the diaphragm and other breathing muscles, or when muscles at the top of the throat become too relaxed, allowing the windpipe to partially close. Sufferers stop breathing for up to 30 seconds or more as they sleep. Hundreds of episodes may occur each night. Often the individual will not remember any of them, but will feel sleepy the next day. The biggest concern with sleep apnea is that the repeated episodes of breathing cessation stress the heart and can eventually lead to cardiac arrest. As well, people with sleep apnea are not getting sufficient rest and are at increased risk for fatigue-related problems while driving or working (Garbarino et al., 2016). Sleep apnea can usually be stopped completely by using a positive flow ventilator that keeps throat tissue open and stops the snoring and the breathing interruptions associated with this issue. Even athletes and physically fit people like Shaquille O'Neal can have sleep apnea (see photo).

sleep apnea sleep disorder characterized by repeatedly ceasing to breathe during the night, depriving the brain of oxygen and leading to frequent awakenings.

Lisa Lake/Getty Images

Sleep apnea NBA legend Shaquille O'Neal, who participated in a Harvard Medical School sleep study, has been diagnosed with sleep apnea (Harvard Medical School,

2013).

Central Disorders of Hypersomnolence

Excessive daytime sleepiness is characterized by feeling drowsy or chronically tired even after having a good night sleep. Prevalence estimates suggest that as many as 18 percent of the population fit this category (Slater & Steier, 2012). (This condition is not the same as the daytime sleepiness you may feel because you pulled an all-nighter to study for an exam!) Excessive daytime sleepiness is often seen in individuals with sleep apnea, neurological disorders such as Parkinson's disease, and metabolic disorders such as diabetes and obesity. It is also more commonly reported in individuals who suffer with depression and/or anxiety (Fernandez-Mendoza et al., 2015; Slater & Steier, 2012; Tholfsen et al., 2015). Similar to sleep apnea, excessive daytime sleepiness has been correlated to an increase in motor vehicle accidents (Garbarino et al., 2016) and may negatively influence academic performance (Kaur & Singh, 2017; Ozder & Eker, 2015).

Narcolepsy is marked by an uncontrollable urge to fall asleep. This disorder affects approximately 1 in 2000 people (Scammell, 2015). People with this disorder may suddenly fall asleep in the midst of an argument or during an exciting football game. The narcoleptic episode is experienced as a loss of consciousness that can last up to 15 minutes. Some people with narcolepsy further experience sudden loss of muscle tone during their narcoleptic episodes. This disorder can obviously have serious consequences for people driving cars, operating tools, or performing highly precise work. Its cause is not fully known. Narcolepsy seems to run in families, and some studies have linked the disorder to a specific gene or combination of genes in both humans and dogs (Taheri, 2016). Recent work by Maan Lee and his colleagues at the Montreal Neurological Institute has helped to identify orexin or hypocretin receptors in the hypothalamus and their potential role in narcolepsy. When these receptors under-function, narcolepsy results (Hassani et al., 2016; Lee, Hassani, & Jones, 2005; Mieda, 2017). This sort of finding could eventually lead to a treatment for narcolepsy.

narcolepsy sleep disorder marked by uncontrollable urge to fall asleep.

Circadian Rhythm Sleep-Wake Disorders

Delayed sleep phase syndrome is characterized by a long delay in a person's ability to fall asleep, often hours past the time they wish to fall asleep. Difficulty in waking up at the desired time in the morning is also characteristic of this disorder. It is commonly diagnosed in adolescents and young adults and this condition may be a contributing factor of insomnia (Micic et al., 2016). Studies suggest that up to 16 percent of adolescents have difficulty falling asleep at their desired time. Difficulties with daytime sleepiness, anxiety, and depression may be present in those who have this disorder. Treatments for this disorder may include cognitive behavioural and/or bright light therapy during the day to help train the brain to fall asleep at a particular time, but relapse is common (Gradisar & Cowley, 2013; Gradisar et al., 2011).

Advanced sleep phase syndrome is not as well studied as delayed sleep phase disorder. Individuals with this sleep difficulty tend to fall asleep early in the evening, between 6 and 9 p.m., prior to their desired time to fall asleep. They wake up in the early hours of the day, between 2 and 5 a.m., well before their desired time to wake. In contrast to delayed sleep phase syndrome, this disorder is more common in middle-aged and older individuals and may be related to genetic factors (Zee, Attarian, & Videnovic, 2013).

Sleep-Related Movement Disorders

Restless legs syndrome (RLS) and *periodic limb movements of sleep (PLMS)* are disorders where individuals have strong urges to move their legs, usually in the evenings just prior to falling asleep, or during sleep in the case of PLMS. This condition is typically considered a sleep disorder since it usually gets worse when a person is still and just prior to going to sleep. Individuals describe this disorder as one where their legs are uncomfortable and they feel pins and needles, or experience a crawling feeling under the skin of their legs that leads to an uncontrollable urge to move their legs. This constant need to move their legs can become intolerable and make it difficult for sufferers to fall asleep and stay asleep. For most people with RLS or PLMS, the feelings improve in the morning, providing some temporary relief, only to return again in the evening. Between five to 10 percent of the population may have one of these two disorders (Kendzerska, Kamra, Murray, & Boulos, 2017). These disorders have been associated with an increase in sleep deprivation and insomnia, which can affect mood and daytime sleepiness, and may be related to increases in early mortality. Abnormalities in dopamine neurotransmitter system function is likely related to both disorders (Sieminski, Pyrzowski, & Partinen, 2017; Venkateshiah & Ioachimescu, 2015).

Darren McCollester/Getty Images

Sleepwalker This realistic sculpture was part of a temporary exhibit by artist Tony Matelli at Wellesley College's Davis Museum in Wellesley, Massachusetts.

Parasomnias

Sleepwalking (somnabulism) most often takes place during the first three hours of sleep (Dogu & Pressman, 2011; Stallman & Kohler, 2016). Sleepwalkers will often sit up, get out of bed, and walk around (see photo). They usually avoid obstacles, climb stairs, and perform complex activities. Accidents do happen, however: tripping, bumping into furniture, and even falling out of windows have all been reported. People who are awakened while sleepwalking are confused for several moments. If allowed to continue sleepwalking, they eventually return to bed. The disorder appears to be inherited (Gregory et al., 2017). Up to 5 percent of children experience this disorder for a period of time, and up to 7 percent have at least one episode during their lifetimes (Stallman & Kohler, 2016).

As an extreme example of sleepwalking, consider the case of Ken Parks, who lived in Pickering, Ontario. One night Parks fell asleep on the couch, arose in the middle of the night, drove across town, entered the home of his parents-in-law, and, using a tire iron and knife, killed his mother-in-law and nearly killed his father-in-law. He drove himself to a police station and turned himself in, saying, in a confused state, he thought he had killed someone. At trial, Parks's lawyer argued he was sleepwalking (actually, that he was in a state of noninsane automatism, or that he was not acting voluntarily) and therefore should not be held accountable for his actions. The jury agreed and acquitted him of murder. The Supreme Court of Canada upheld the acquittal. Others have tried to use this defence and were found guilty. There is currently much debate in legal, medical, and psychological

circles as to whether sleepwalking ought to be considered a legitimate defence (Popat & Winslade, 2015; Horn, 2005). For most of us, during REM sleep, signals in the brain shut down the system that controls movement, which stops us from sleepwalking (see Your Brain and Behaviour 6.1).

Night terrors are related to sleepwalking. Individuals who suffer from this pattern awaken suddenly, sit up in bed, scream in extreme fear and agitation, and experience heightened heart and breathing rates. They appear to be in a state of panic and are often incoherent. Usually people suffering from night terrors do not remember the episodes the next morning. Recent data from the Quebec Longitudinal Study of Child Development showed that night terrors peak at around one and a half years of age in contrast to sleepwalking, which peaks around 10 years of age. Interestingly, parental history of sleepwalking predicted an increased likelihood of night terrors and sleepwalking in their children, suggesting a familial, or genetic, component in these disorders (Petit et al., 2015). Night terror disorder is not the same thing as a *nightmare disorder*, discussed earlier in the chapter, in which sufferers experience frequent nightmares. Sleepwalking and night terrors are more common among children than among adolescents or adults. They tend to occur during Stages 3 and 4, the deepest stages of NREM sleep (Arnulf, 2018; Patel & Araujo, 2018).

REM Sleep Behaviour Disorder Imagine being sound asleep beside someone only to have them kick you unexpectedly. Upon waking, you realize the person beside you is sound asleep. They appear to be dreaming but rather than the usual small twitches that often occur they are moving about vigorously, and appear to be acting out their dream. This type of behaviour is typical of REM sleep behaviour disorder and its prevalence has been reported at around 7 percent of community-dwelling, or cohabitating, sleeping in the same bed, adults (Jung & St. Louis, 2016). As you read in the previous sections on sleep and dreaming, we pass through various stages of sleep throughout the night. One of these stages, REM, is often characterized by vivid dreams and high levels of electrical activity in the cortex, similar to levels you would see in an awake individual. During these REM dreams, our hindbrains typically send signals to the cortex, limbic system, and basal ganglia to keep the body in a relatively paralyzed state. For some individuals this temporary paralysis (known as atonia) doesn't occur and behaviours that occur in their dreams, during this REM sleep period, may be acted out in real life (Blumberg & Plumeau, 2016; Patel & Araujo, 2018). This disorder is commonly associated with aging and neurodegenerative disorders such as Parkinson's disease (Howell & Schenck, 2015).

6.1 Your Brain and Behaviour

Getting a Good Night's Sleep

If you're like most people, you fall asleep when you are tired and need to rest. After an uninterrupted night's sleep or nap, you probably feel refreshed and better able to face life's challenges. Given how rested you feel after sleeping, it may surprise you to hear that while you sleep, your brain is incredibly active—it's not resting at all, or at least it is certainly not inactive! Each stage of sleep is characterized by a different pattern of brain activity.

During REM sleep, a time of active dreaming, signals in the brain shut down the system that controls movement in most people. Preventing movement probably saves us from potentially dangerous actions we could take if we acted out our dreams, which can happen in individuals with REM sleep behaviour disorder (Arnulf, 2012).

During slow-wave sleep, studies have shown that many circuits in the brain replay patterns of activity that work to strengthen new memories. That may be why being deprived of sleep, a common occurrence for college or university students, is associated with problems remembering facts over the long term. Scientists don't fully understand why we sleep, but they all agree that the brain doesn't function optimally without it.

Questions

What is the physiological explanation for why people typically do not act out their dreams?

Inadequate sleep seems to disrupt neuron formation in which region of the brain?

Explain the relationship between sleep, hunger, and weight.

Improving cognition
Sleep allows for neuronal growth in the brain. Sleep deprivation prevents the addition of new neurons to the hippocampus, a brain region important for cognition and anxiety regulation. This may be one reason sleep deprivation weakens our ability to learn and increases the likelihood of mood disturbances.

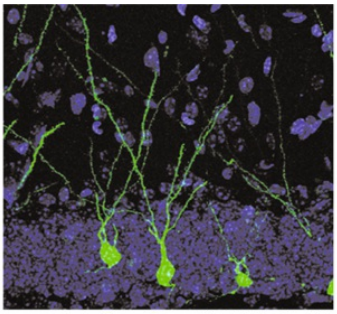
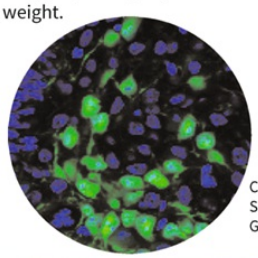
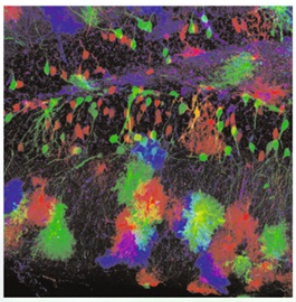


Image adapted from Neuron 54, 2007 (by Kurt Sailor, Guo-li Ming, and Hongjun Song at Johns Hopkins School of Medicine)

Improving metabolism Sleep helps the brain to regulate metabolism. Sleep deprivation increases the peptide ghrelin and decreases the peptide leptin. Changes in the levels of these chemicals both work on neurons of the hypothalamus, shown here as green-stained neurons, to stimulate hunger—this may be one reason why sleep-deprived people are more likely to gain weight.

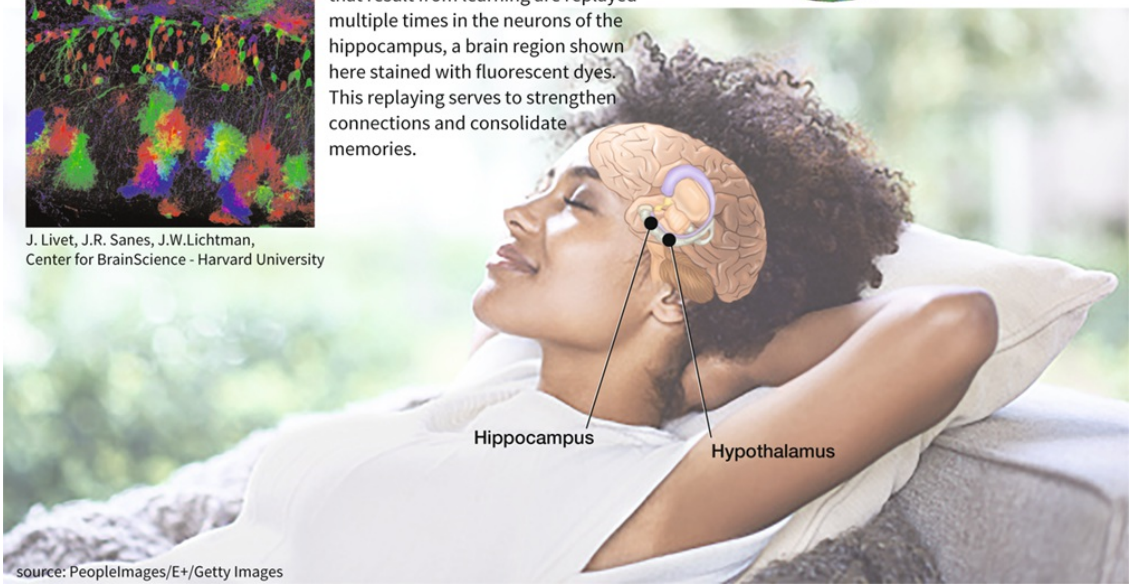


Courtesy of Sebastien G. Bouret



J. Livet, J.R. Sanes, J.W.Lichtman, Center for BrainScience - Harvard University

Locking in memories During slow-wave sleep, patterns of activity that result from learning are replayed multiple times in the neurons of the hippocampus, a brain region shown here stained with fluorescent dyes. This replaying serves to strengthen connections and consolidate memories.



source: PeopleImages/E+/Getty Images

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

5. What are the major theories of why people sleep?

6. What are the possible effects of sleep deprivation on our health and cognition?

7. What is the role of the suprachiasmatic nucleus in human consciousness?

8. What is the difference between a nightmare and a night terror?

What Do You Think? • Which of the theories of dreams described in this section is closest to your own theory of dreams (before you read this section and found out about the science in this area)? Are there other studies we should do to better understand dreaming?

Altered States of Consciousness: Hypnosis

LEARNING OBJECTIVE 4

Discuss theories and evidence about what hypnosis is, how it works, and how it can be used.

In movie and cartoon portrayals of hypnosis, a creepy guy dressed in black tells an unsuspecting person to stare at a swinging pocket watch and says, "Follow the watch. . . You are getting sleepy, sleeeeepy, sleeeeepy." Soon, the person is completely under the power of the hypnotist, who often makes him or her do something completely out of character or, in more sinister films, illegal and dangerous. As you might expect, this portrayal is exaggerated and distorted.

The idea that **hypnosis** produces an altered state of consciousness or a trance-like state is only one explanation offered by psychologists (Lynn et al., 2015; Kihlstrom, 2015b; Lynn, Rhue, & Kirsch, 2010). During hypnosis, people can be directed to act in unusual ways, experience unusual sensations, remember forgotten events, or forget remembered events. An alternative, and classic, explanation for these behaviours was developed by Nick Spanos working at Carleton University (Kihlstrom, 2018; Spanos, Mondoux, & Burgess, 1995). Spanos argued that hypnosis subjects are actually role-playing—acting as they believe hypnotized people should act. We will look at these two explanations for hypnosis in more detail.

> **hypnosis** a seemingly altered state of consciousness during which individuals can be directed to act or experience the world in unusual ways.

People typically are guided into this suggestible state by a trained hypnotist or hypnotherapist. The process involves their willing relinquishment of control over certain behaviours and their acceptance of distortions of reality. For hypnosis to work, individuals must be open and responsive to suggestions made by the hypnotist. Some people are more open to a hypnotist's suggestions than others, a quality that often runs in families (Barnier & Council, 2010; Gfeller & Gorassini, 2010). Approximately 15 percent of adults are very susceptible to hypnosis, while 10 percent are not at all hypnotizable. Most adults fall somewhere in between (Oakley & Halligan, 2013). People who are especially suggestible are also more likely to do what other people tell them to do even when they are not hypnotized, a finding that supports Spanos's view of hypnosis as role-playing (Lynn, Laurence, & Kirsch, 2015). Perhaps not surprisingly, therefore, children tend to be particularly suggestible (Kohen & Kaiser, 2014; Olness & Kohen, 2010). There are big differences between the scientific study of hypnosis and the stage shows put on by hypnotists.

Hypnotic Procedures and Effects

Hypnotists use various methods to induce the hypnotic state (Gibbons & Lynn, 2010). Sometimes—in a much tamer version than the movie portrayals—a person is asked to relax while concentrating on a single small target, such as a watch or an item in a painting

on the wall. At other times, the hypnotist induces a *hyperalert* hypnotic trance that actually guides the individual to heightened tension and awareness. In either case, the hypnotist delivers "suggestions" to the subject, not the authoritarian commands on display in the movies.

One area of functioning that can be readily influenced by hypnotists is motor control. If the hypnotist suggests that a person's hand is being drawn like a magnet to a nearby stapler, the individual's hand will soon move to the stapler, as if propelled by an external force (see the photo).

PaulaConnelly/Getty Images

The power of suggestion **People can be directed to experience unusual sensations and act in unusual ways when in a hypnotic state—a trance-like altered state of consciousness marked by extreme suggestibility. Here, a female hypnotist works with a male patient. The therapist is testing for suggestibility using the light hand, heavy hand test.**

In some cases, people can be directed to respond *after* being roused from the hypnotic trance. A predetermined signal prompts such *posthypnotic responses*. A posthypnotic response is a behaviour that was suggested while the person was hypnotized, but that is engaged in later when a specified sign is observed (Kihlstrom, 2015b). During hypnosis, the hypnotist may suggest, for example, that the person will later stand up whenever the hypnotist touches a desk. After being roused, and with no understanding of why, the person will in fact stand when the hypnotist touches the desk.

Related to posthypnotic responses is the phenomenon of *posthypnotic amnesia*, in which the hypnotist directs the person to later forget information learned during hypnosis. Once again, after being roused from the hypnotic trance, the person does not remember the learned material until the hypnotist provides a predetermined signal to remember (Kihlstrom, 2013; Mazzoni, Laurence, & Heap, 2014). The degree to which the earlier information is forgotten varies. Some people will not remember any of the learned material, while others will remember quite a bit.

Hypnosis can also induce *hallucinations*, mental perceptions that do not match the physical stimulations coming from the world around us. Researchers have distinguished between

two kinds of *hypnotic hallucinations*: positive and negative. Positive hallucinations are those in which people under hypnosis are guided to see objects or hear sounds that are not present. Negative hallucinations are those in which hypnotized people fail to see or hear stimuli that are present. Negative hallucinations are often used to control pain. The hypnotized person is directed to ignore—basically, to simply not perceive—pain. The hallucination may result in a total or partial reduction of pain (Jensen, 2010; Patterson, 2010). Some practitioners have even applied hypnosis to help control pain during dental and other forms of surgery (Allison, 2015). Although only some people are able to undergo surgery while anesthetized by hypnosis alone, combining hypnosis with chemical forms of anesthesia apparently helps many individuals (Ravalia, 2019). Beyond its use in the control of pain, hypnosis has been used successfully to help treat a variety of problems, such as anxiety, skin diseases, asthma, insomnia, stuttering, high blood pressure, warts, and other forms of infection (Covino & Pinnell, 2010; Mellinger, 2010).

Many people also turn to hypnosis to help break bad habits, such as smoking, nail biting, and overeating. Does hypnosis help? Research has shown that hypnosis does indeed help some people to quit smoking (Carmody et al., 2017; Herring, 2019; Green, 2010). It also helps many people to better control their eating and lose weight, particularly if hypnosis is paired with cognitive treatments, interventions that help people change their conscious ways of thinking (Milling, Gover, & Moriarty, 2018).

Why Does Hypnosis Work?

There are various theories about why hypnosis works (Lynn et al., 2010; Kihlstrom, 2013; Terhune, Cleeremans, Raz, & Lynn, 2017). One view is that hypnosis is a state of *divided consciousness* (Sadler & Woody, 2010; Terhune, Cleeremans, Raz, & Lynn, 2017). Another theory suggested by Canadian Nick Spanos (Spanos et al., 1995; Heap, 2016; Wickramasekera, 2015), who worked at Carleton University (prior to his death in 1994), sees hypnosis as an implementation of *common social and cognitive processes* or role-playing (see **Figure 6.10**).

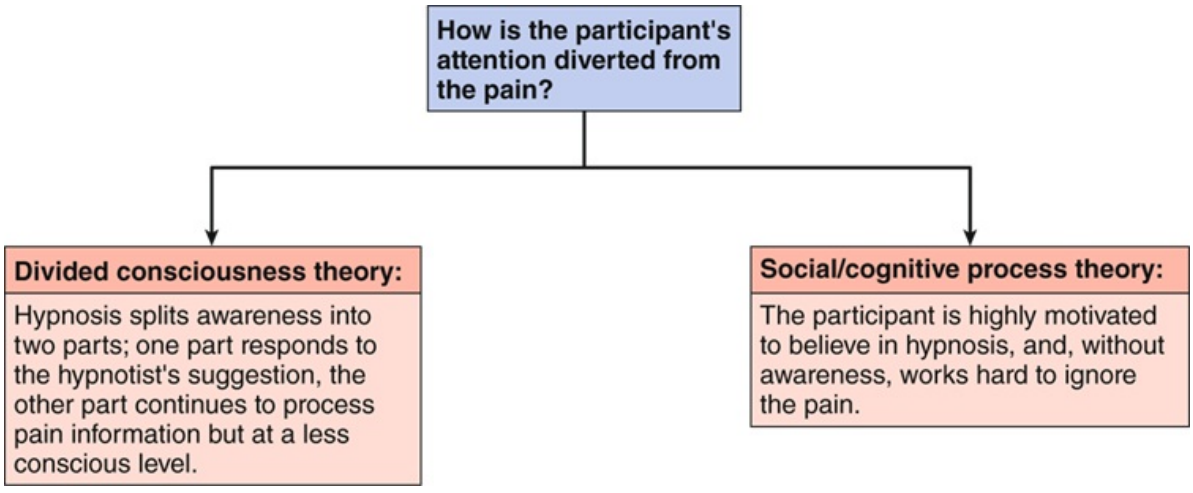


FIGURE 6.10 Explaining hypnosis Two possible theories explaining how a hypnotized individual is able to ignore pain.

Ernest Hilgard demonstrated that people hypnotized and instructed that they could "not

hear" loud noises can indicate, by raising a finger or other behavioural response, that "some part" of them could still hear noise (Hilgard, 1992; Heap, 2016). From this result, Hilgard concluded that consciousness splits into two parts and that both act at once during hypnosis, an experience called **dissociation** (Cleveland, Korman, & Gold, 2015; Sadler & Woody, 2010). One part of our consciousness becomes fully tuned into and responsive to the hypnotist's suggestions. The second part, which Hilgard called the *hidden observer*, operates at a subtler, less conscious level, continuing to process information that is seemingly unavailable to the hypnotized person. According to Hilgard, the hidden observer was the part of the student's mind that was still able to hear while hypnotized.

dissociation a splitting of consciousness into two dimensions.

In direct opposition to Hilgard, Nick Spanos developed a different theory of hypnosis, which held that hypnosis is not an altered state of consciousness. Spanos's theory is that, instead of resulting from a divided consciousness, hypnotic phenomena consist simply of highly-motivated people performing tasks, being extra attentive, and enacting roles that are asked of them—that is, they are playing a part in a social interaction between themselves, the "hypnotist," and the audience. Because of their strong beliefs in hypnosis, the people fail to recognize or ignore their own active contributions to the process (Haley, 2015; Dienes et al., 2009; Spanos et al., 1995). In a similar manner, people who are hypnotized and regressed to an earlier age will often be able to describe their sixth birthday in great detail, suggesting that hypnosis has greatly enhanced their memory abilities. Typically, however, audiences at hypnosis shows do not check the details of those hypnosis-assisted memories. Martin Orne (1951), in a classic study, did check the accounts of early life events told by hypnotically regressed people (by talking to their parents); he found that their vivid accounts of early birthdays and other life events were largely made up. Recent research on this topic has confirmed that hypnotizability can influence memory development and recall (Dasse, Elkins, & Weaver III, 2015; Mazzoni, Laurence, & Heap; 2014). These data better support Spanos's view than Hilgard's.

What Happens in the Brain During Hypnosis

When people are hypnotized, they are usually first guided into a state of *mental relaxation*. Studies have found that during this state, neural activity in key areas of the cerebral cortex and thalamus—brain regions that, as we noted earlier, are implicated in conscious awareness—are altered by hypnosis (Landry, Lifshitz, & Raz, 2017). Hypnotized individuals are next guided into a state of *mental absorption*, during which they focus carefully on the hypnotist's voice and instructions and actively block out other sources of stimulation, both internal and environmental. In fact, mental absorption has often been described as a state of *total focus*. During this state, cerebral blood flow and neural activity actually speed back up in key areas of the cerebral cortex, thalamus, and other parts of the brain's attention and conscious awareness systems (Jiang et al., 2016; Naish, 2010; Oakley & Halligan, 2010).

Neuroimaging research suggests that one part of the brain's cerebral cortex, the *anterior cingulate cortex*, may be particularly involved when hypnosis is used to anesthetize or reduce pain (**Figure 6.11**). This region has been implicated both in general awareness and

in the unpleasantness we feel during pain. While individuals are in a hypnotic pain-free state, neurons in their anterior cingulate cortex become markedly less active. Although the activity of other neurons that receive pain messages continue as usual in people's brains—suggesting that they are indeed receiving sensations of pain—the decreased activity in the anterior cingulate cortex seems to reduce their *awareness* of the pain (Landry, Lifshitz, & Raz, 2017; Vanhaudenhuyse, Laureys, & Faymonville, 2014).

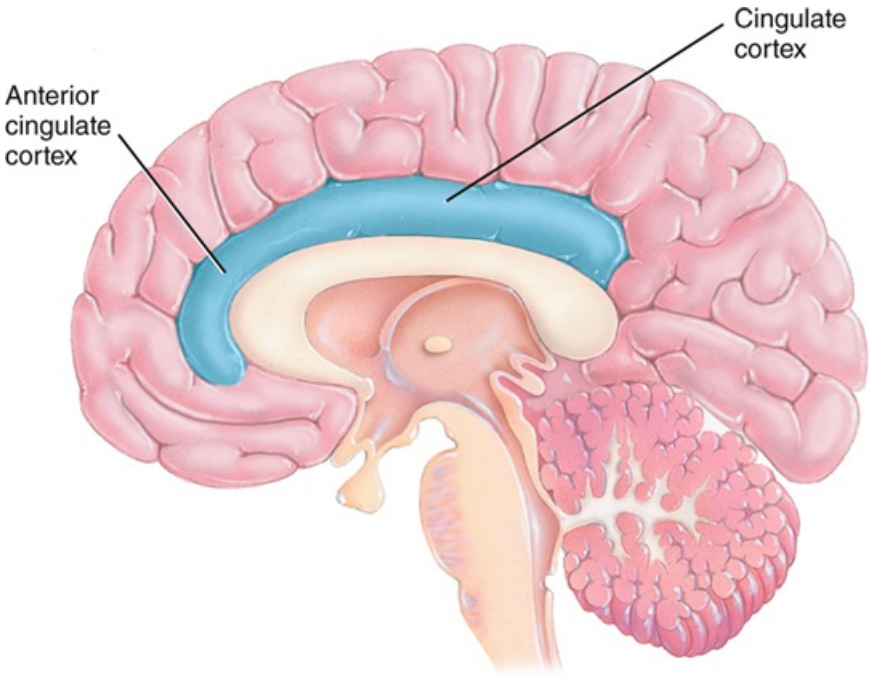


FIGURE 6.11 Hypnosis and pain **Neuroimaging research suggests that the brain's *anterior cingulate cortex* may be particularly involved when hypnosis is used to anesthetize or reduce pain.**

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

9. What are hypnotic hallucinations and how might they be useful?

10. What are the two different theories that explain how hypnosis influences pain perception? Where in the brain is activity changed during hypnosis for pain?

What Do You Think? • What are the ethical implications of using hypnosis to control behaviour?

Altered States of Consciousness: Psychoactive Drugs

LEARNING OBJECTIVE 5

List and describe common depressant, stimulant, and hallucinogenic psychoactive drugs and their effects.

What is one of the first things you do every day? For millions of people, the answer is to have a cup of coffee (maybe more than one). Why do so many people do this? For most, it is to give themselves a bit of a jolt and get the day going. Similarly, people often use other substances to help improve, or at least change, how they feel or function. Many people smoke cigarettes to feel more alert, less anxious, or both. Others may have a glass of wine or beer in the evening to wind down from a hectic day or participate in an event specific to their culture. (See Indigenous Experiences 6.1.)

These substances—coffee, cigarettes, and alcohol—along with many others, alter our state of consciousness and influence our moods and behaviours. Collectively, they are examples of **psychoactive drugs**, chemicals that affect awareness, behaviour, sensation, perception, or mood. Some such drugs are illegal chemicals (heroin, ecstasy, cocaine), others are common and legal. **Table 6.2** shows the three broad categories of drugs and lists examples of specific drugs that fall within those categories.

> **psychoactive drugs** chemicals that affect awareness, behaviour, sensation, perception, or mood.

Some of the changes brought about by psychoactive drugs are temporary, lasting only as long as the chemicals remain in the brain and body. But certain psychoactive drugs can also bring about long-term changes and problems. People who regularly ingest them may develop maladaptive patterns of behaviour and changes in their body's physical responses, a pattern commonly called **addiction**. (See Practically Speaking 6.1.)

> **addiction** psychological or physical compulsion to take a drug, resulting from regular ingestion and leading to maladaptive patterns of behaviour and changes in physical response.

6.1 Indigenous Experiences

Smudging as a Spiritual Act

Many Indigenous people believe in a sacred connection between the Creator and the gifts of Creation provided for existence and life (Castleden, Martin, & Lewis, 2016). Life is perceived as a balance among physical, emotional, mental, and spiritual elements and each element is viewed as inextricably bound to the others. This holistic approach to identity also includes a powerful commitment to family, ancestors, and community. Thus, Indigenous people view health and healing as a lifelong spiritual journey involving the creation of balance, harmony, wholeness, and connection. Spiritual teachings, ceremonies, prayers, and traditions of healing and cleansing such as sweat

lodges, smudging, drumming, or brushing, provide a means to address underlying spiritual issues and to connect to a shared Indigenous history, and thus serve to strengthen cultural identity and re-establish cultural connections.

Smudging is a spiritual act that serves as a form of prayer and as a part of many rituals to calm the central nervous system and to purify and heal people and places of negative energy with the cleansing smoke. The smoke is also thought to carry prayers to the Creator. Smudging involves burning a bundle of one or more of the sacred herbs —sweetgrass, sage, cedar, and tobacco—and using an eagle feather or hand to spread the smoke. The smoke is believed to have healing powers and is inhaled as it reaches a person. The smoke is believed to clear negative energies in a space or person and bring harmony and clarity and restore spiritual, physical, and emotional balance. Further, each herb has a place on the medicine wheel. In some cultures, physical elements are also represented on the wheel, in the herbs themselves (earth), burning of the sacred herbs (fire), feather (air), and water in the container to carry the herbs. Different cultures and peoples have their own rituals and practices, and, in Metis or Inuit ceremonies, other herbs or medicines are often used (Adams et al., 2018).

Indigenous people have their own terms for the English word "smudging"; for example, *atisamânihk*, which is Cree for "at the smudge," or *nookwez*, which is Ojibwe for "smudge medicinally" (Robinson, 2018). Smudging is often led by an Elder or a spiritual leader but can also be used by individuals, particularly as a part of prayer.

Jesse Winter/Toronto Star/Getty Images

A spiritual act A woman participates in a smudging ceremony involving the burning of one or more of the four sacred herbs used in Indigenous ceremonies: sweetgrass, sage, cedar, and tobacco.

Since smudging is often used to clear a space of accumulated negative energy to replace it with more positive energy, allowing for healing and restoration of emotional balance, it is often used as a part of Indigenous healing practice. Some also use it as a way to create a positive environment for meditation or prayer. A participant welcomed by an Elder to a healing session with prayer and smudging said, "That brought comfort and soothing, healing my soul. That's what she brought to me. Yeah so I've been doing

a lot more cleansing of the house . . . but now every two days . . . I wake up and I cleanse myself" (Hadjipavlou et al., 2018, p. E613).

Critical Thinking Questions

What is the purpose of smudging?

The smoke from smudging is believed to have what kind of powers?

What types of substances are often used during a smudging ritual?

TABLE 6.2

Psychoactive Drugs and Their Effects

Drug Class	Action in the Brain	Effects	Excessive Use or Overdose Effects
Depressants		**Depress and excite activity of central nervous system**	**Anxiety, nausea, vomiting, constipation, disorientation, impaired reflexes and motor functioning, amnesia, loss of consciousness, shallow respiration, convulsions, coma, death**
Alcohol	Influences the receptors for the GABA neurotransmitter	Slows down brain areas that control judgment, inhibition, behaviour (speech, motor functioning, emotional expression)	
Sedative-hypnotics (benzodiazepines)	Influences the function of the receptors for GABA; GABA's inhibitory effect on other neurons decreases neural activity throughout the brain	Produces relaxation and drowsiness, relieves anxiety	
Opioids (opium, heroin, morphine, codeine,	Activates opioid receptors in the brain, producing	Reduces pain and emotional tension,	

methadone)	their analgesic effect and their related high	produces pleasurable and calming feelings	
Stimulants		**Increase activity of central nervous system**	**Insomnia, restlessness, increased pulse rate, mild delirium, ringing in the ears, rapid heartbeat, irritability, stomach pains, vomiting, dizziness, cancer, heart disease, emphysema, anxiety, paranoia, hallucinations, psychosis, elevated blood pressure and body temperature, convulsions, death**
Caffeine	Blocks the ability of adenosine to bind to its receptors; produces sensations of drowsiness when it activates adenosine receptors	Increases alertness	
Nicotine	Binds to acetylcholine nicotinic receptors	Increases alertness, and arousal and reduces stress	
Cocaine	Blocks re-uptake of dopamine, norepinephrine, and serotonin	Increases energy and alertness, produces euphoric feelings of well-being and confidence	
Amphetamines	Increase release of dopamine and norepinephrine	Increases energy and alertness, reduces appetite, produces euphoric feelings	
Hallucinogens		**Enhance normal perceptions**	**Panic, nausea, headaches, longer and more extreme delusions, hallucinations, perceptual distortions (“bad trips”), psychosis, perceptual and sensory distortions, fatigue, lack**
LSD	Stimulates dopamine and	Dramatically strengthens	

	serotonin receptors	visual perceptions (including illusions and hallucinations) along with profound psychological and physical changes	**of motivation, impaired memory**
THC from cannabis	Stimulates cannabinoid receptors	Produces a mixture of hallucinogenic, depressant, and stimulant effects	
MDMA (Ecstasy)	Causes presynaptic release of serotonin, dopamine, and norepinephrine	Enhances sensory perceptions, increases energy and alertness, produces feelings of empathy and emotional well-being	

Those addicted to a drug feel psychologically and physically compelled to keep taking it. They rely on the drug excessively and chronically, and may damage their family and social relationships, function poorly at work, or put themselves and others in danger. Addicted individuals may also acquire a physical dependence on the drug. They may develop a **tolerance** for the drug, meaning they need larger and larger doses to keep feeling its desired effect. And, if they try to stop taking or cut back on the drug, they may experience unpleasant and even dangerous **withdrawal symptoms**, such as nausea, cramps, sweating, or anxiety. People in withdrawal may also *crave* the drug that they had been taking regularly. Even if they want to quit taking it, the knowledge that they can quickly eliminate the unpleasant withdrawal symptoms by simply ingesting the drug makes it difficult for many users to persevere through the withdrawal period (Verster, Brady, Galanter, & Conrond, 2011). In any given year, 2.5 percent of all teens and adults in Canada, around 700,000 people, use cocaine, ecstasy, or hallucinogens, and 194,000 Canadians (0.8 percent) are dependent on illicit drugs (Health Canada, 2014).

tolerance mark of physical dependence on a drug, in which the person is required to take incrementally larger doses of the drug to achieve the same effect.

withdrawal symptoms unpleasant and sometimes dangerous side effects of reducing intake of a drug after a person has become addicted.

Depressants

Psychoactive drugs that lower the neurotransmission of several neurotransmitters (see Table 6.2) in the central nervous system are called **depressants**. They reduce tension and inhibitions and may interfere with a person's judgment, motor activity, and concentration. The two most widely used groups of depressants are *alcohol* and *sedative-hypnotic drugs*.

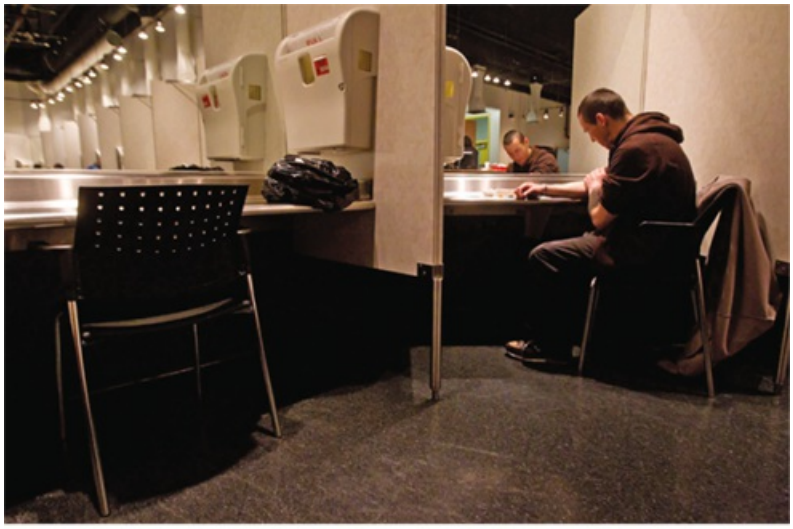
depressants class of drugs that slow the activity of the central nervous system.

6.1 Practically Speaking

Addictions: Living out of Control

Many people struggle with addiction problems. According to some clinical theorists, addictions are not only about alcohol and substance abuse; they may also cover dependencies such as food, the Internet, Internet gaming, gambling, caffeine, shopping, sex, and exercise, to name a few (De La Vega, Parastatidou, Ruiz-Barquin, & Szabo, 2016; Pontes & Griffiths, 2014; Rogers, 2017). Addictive patterns do not suddenly appear; they are usually long-standing and may be rooted in various psychological problems. Whereas it takes time for individuals to lose control of their life to a dependency, it also takes time, motivation, commitment, discipline, and often the help of a professional treatment program to regain control and recover from an addiction. There are no quick fixes for recovery.

How do you know whether you or someone close to you is experiencing an addiction? This is a complex issue that typically requires careful clinical assessment for a definitive answer. Nevertheless, there are some straightforward questions that you can use to determine whether professional attention is in order. For example, is the person unable to meet responsibilities at home, school, or the office? Has the person tried to stop the repeated behaviour but cannot, and continues to engage in it despite the apparent dangers?



Darryl Dyck/The Canadian Press

Reducing harm Vancouver's Coastal Health Service opened a safe injection site near Vancouver's Downtown Eastside in 2003. It offers clean needles and supervision of injections by heroin users, as well as support and referrals for treatment.

Although most clinicians agree that there is no substitute for careful clinical assessment and treatment of addictions, some have developed basic detection devices that can help get the ball rolling. For example, a brief tool to detect alcohol addiction is known as the CAGE questionnaire. It asks these questions: (1) Has the person ever felt that they should CUT DOWN on the drinking? (2) Has the person ever been ANNOYED by people criticizing the drinking? (3) Has the person ever expressed remorse or GUILT about drinking? (4) Has the person ever started to drink in the morning as an EYE-OPENER to start the day or get rid of a hangover? A "yes" answer to at least two of these questions may indicate a problem with alcohol addiction and a corresponding need for professional assessment and treatment. More than a quarter century after the CAGE questionnaire was first developed, it has been validated in many studies as an effective, quick indicator of the need for help (Ewing, 1984; Williams, 2014).

Alcohol

Alcohol, a depressant that is taken in liquid form, is one of the most commonly used psychoactive drugs. In contrast to many of the drugs discussed in the rest of this section, alcohol doesn't carry the same stigma when used, and drinking alcohol is often expected at social events (Banerjee, 2014). More than three-quarters of the people in Canada drink beverages that contain alcohol, at least from time to time (Health Canada, 2014). In 2016 approximately 5.8 million Canadians self-reported heavy drinking (males five drinks or more, and females four drinks or more, at a time, at least once a month for a year). Males were more likely to report heavy drinking (23.8 percent) than females (14.2 percent) (Statistics Canada, 2017).

All alcoholic beverages contain *ethyl alcohol*, a chemical that is quickly absorbed into the

blood through the lining of the stomach and the intestine. Ethyl alcohol immediately begins to take effect as it is carried in the bloodstream to the central nervous system (the brain and spinal cord). There, it acts to slow neural transmission by binding to various neurotransmitter receptors, particularly those that normally receive a neurotransmitter called *gamma aminobutyric acid*, or *GABA*. Alcohol changes the way GABAergic neurons and receptors work, making them more efficient. Since GABA is a major inhibitory neurotransmitter in the brain, upregulating GABA effects on other neurons means that the neurons influenced by GABA neurons decrease their action, thus alcohol is a CNS depressant.

At first, ethyl alcohol inhibits the brain areas that control judgment and inhibition; people become looser and more talkative, relaxed, and happy. When more alcohol is absorbed, it inhibits additional areas in the central nervous system, and drinkers make poorer judgments, become careless, and have issues with memory. Many people become highly emotional, and some become loud and aggressive.

The motor responses of individuals decline and their reaction times slow as they continue to consume alcohol. They may be unsteady when they stand or walk, their vision becomes blurred, and they may misjudge distances. They can also have trouble hearing. As a result, people who have drunk too much alcohol may have enormous difficulty driving or solving simple problems (Duke & Bègue, 2015; Martin et al., 2013).

As summarized in **Table 6.3**, the *concentration*, or proportion, of ethyl alcohol in the blood determines how much it will affect a person (Ksir, Hart, & Oakley, 2008). When alcohol concentration reaches 0.06 percent of the blood volume, a person usually feels relaxed and comfortable. By the time it reaches 0.09 percent, the drinker crosses the line into *intoxication*. If the level goes as high as 0.55 percent, death may result. Most people, however, lose consciousness before they can drink enough to reach this level. The effects of alcohol subside only when the alcohol concentration in the blood falls.

Though legal, alcohol is actually one of society's most dangerous drugs, and its risks extend to all age groups. In fact, 10 percent of Canadian elementary school students have admitted to some alcohol use, and nearly 45 percent of 15- to 19-year-olds reported at least one episode of heavy drinking over a year, with about half of those doing so at least monthly (Statistics Canada, 2004). Surveys indicate that over a one-year period, 6.6 percent of all adults in the world fall into a long-term pattern of alcohol addiction, known as **alcoholism** or alcohol use disorder (Le Berre, Fama, & Sullivan, 2017; Salvatore, Bin Cho, & Dick, 2017). Chronic excessive alcohol use can lead to cognitive impairments, social difficulties, and problems with executive function or good decision making. Over 10 percent of adults experience this pattern at some time in their lives, with men outnumbering women (Rush et al., 2010; Salvatore, Bin Cho, & Dick, 2017). Some 14 percent of Canadians reported an increase in consumption of alcohol during the early COVID-19 period (March/April 2020). This increase was greater in individuals who also reported fair to poor levels of self-perceived mental health states (Rotermann, 2020).

alcoholism long-term pattern of alcohol addiction.

Binge drinking is the consumption of five or more drinks in a row for males, and four or

more on one occasion for females. In Canada, between 1996 and 2013, self-reported binge drinking has increased, more so in women than men (Bulloch, Williams, Lavorato, & Patten, 2016). This style of alcohol consumption is a major problem in many settings, not the least of which are high schools and college and university campuses (Winograd & Sher, 2015). According to current Canadian research in Ontario up to 25 percent of high school students in Grades 10 to 12 report binge drinking. This number increases to over 36 percent in Grade 12 (Herciu, Laxer, Cole, & Leatherdale, 2014; Leatherdale, 2015). The COMPASS study, a prospective research conducted in Alberta and Ontario, found that binge drinking in high school students was linked to poorer school performance and engagement and may affect future academic success (Patte, Qian, & Leatherdale, 2017). Cyberbullying in Canada has also been found to contribute to alcohol consumption and binge drinking in high school students (Kim, Boyle, & Georgiades, 2017). For Canadians between 20 and 34, 32 percent report binge drinking 12 or more times in one year. This number declines to 19 percent for Canadians between 35 and 44 (Centre for Addiction and Mental Health, n.d.). On many college and university campuses, alcohol use often is an accepted part of life. Thirty-two percent of Canadian undergraduates report engaging in hazardous or harmful patterns of drinking, with the percentage being higher (43 percent) for those living in residence. Happy hours and other promotions at campus bars are seen to be part of the problem (Centre for Addiction and Mental Health, 2004; Kypri et al., 2010).

TABLE 6.3

Alcohol's Effects on the Body and Behaviour

Source: Adapted with permission of John Wiley & Sons, Inc., from Carpenter, S., & Huffman, K. (2008). *Visualizing psychology*. Hoboken, NJ: Wiley, p. 129.

Number of Drinks[a] in Two Hours	Blood Alcohol Content (%)[b]	Effect
2	0.06	Relaxed state; increased sociability
3	0.09	Everyday stress lessened
4	0.10	Movements and speech become clumsy
7	0.20	Very drunk; loud and difficult to understand; emotions unstable
12	0.40	Difficult to wake up; incapable of voluntary action
15	0.55	Coma and/or death

[a] A drink refers to one 12-ounce beer, a 4-ounce glass of wine, or a 1.25-ounce shot of hard liquor.

[b] In Canada, the legal blood alcohol level for "drunk driving" varies from 0.05 to 0.08.

Efforts to reduce college/university binge drinking have begun to make a difference. Some universities, for example, now provide substance-free dorms and others provide individual motivational support, via peers, such as the University of Sasketchewan Student Binge Drinking Prevention Program. (Bartlett, Robertson-Boersma, Dell, & Mykota, 2015; Bridges

& Monoj Sharma, 2015; Mun et al., 2015). The implications are clear: high school and college/university drinking, including binge drinking, is more common and harmful than previously believed. And most experts agree that the time has come to attack this enormous problem head on.

Jim West/Alamy Stock Photo

Spreading the word **Perhaps the most successful public effort to reduce drunk driving fatalities has been undertaken by Mothers Against Drunk Driving (MADD). Raising public awareness through ads, campaigns, and lobbying efforts, this organization has helped reduce the number of alcohol-related automobile deaths by 47 percent since it was formed in 1980.**

According to work by Deborah Chansonneuve of the Aboriginal Healing Society in Ottawa, 75 percent of Indigenous Canadians say they have a problem with alcohol in their community, 33 percent say it is a problem in their household, and 25 percent say they have a personal problem with alcohol (Chansonneuve, 2007). Generally, individuals of Asian descent in North America have lower rates of alcoholism than do people from other cultures. As many as one-half of them have a deficiency of *alcohol dehydrogenase*, an enzyme in the liver that is responsible for breaking down and eliminating alcohol from the body, so they react very negatively to even a small intake of alcohol. Such extreme reactions help prevent heavy use (Stickel, Moreno, Hampe, & Morgan, 2017).

People who abuse alcohol drink large amounts regularly and rely on it to help them to do things that would otherwise make them nervous. Eventually the drinking disrupts their social behaviour and their ability to think clearly and work effectively. Many build up a tolerance for alcohol, and they need to drink greater and greater amounts to feel its effects. They also experience withdrawal when they stop drinking. Within hours, for example, their hands and eyelids begin to shake, they feel weak, they sweat heavily, their heart beats rapidly, and their blood pressure rises (APA, 2012).

Alcoholism can wreak havoc on an individual's family, social, and occupational life (Collins, 2016; Finan, Simpson, Schulz, & Ohannessian, 2018). Medical treatment, lost productivity, and losses due to death from alcoholism cost society many billions of dollars each year. The

disorder also has been implicated in more than one-third of all suicides, homicides, assaults, sexual assaults, and accidental deaths (Darvishi, Farhadi, Haghtalab, & Poorolajal, 2015; Herbert, Gilbert, Cottrell, & Li, 2017; Snowden, 2015). Just under 40 percent of all fatal automobile accidents in Canada involved alcohol use (Transport Canada, 2015). The photo captioned "Spreading the word" shows one of the many organizations that are committed to battling drunk driving. Children whose parents have alcoholism are also severely affected by this disorder. The home life of these children often features much conflict and, in some cases, sexual or other forms of abuse. The children themselves have elevated rates of psychological problems and substance-related disorders over the course of their lives (Park & Schepp, 2015). Some display low self-esteem, and higher levels of anxiety, depression, social withdrawal, and attention problems (Haverfield & Theiss, 2016; Omkarappa & Rentala, 2019).

Long-term excessive drinking can also cause severe damage to one's physical health. It so overworks the liver—the body organ that breaks down alcohol—that people may develop an irreversible condition called *cirrhosis*, in which the liver becomes scarred and dysfunctional. Alcohol abuse may also damage the heart and lower the immune system's ability to fight off infections and cancer and to resist the onset of AIDS after infection (Mehta, 2016; Stein et al., 2016; Vagenas et al., 2015).

Finally, women who drink during pregnancy place their fetuses at risk. Heavy drinking early in pregnancy often leads to a miscarriage. Excessive alcohol use during pregnancy may also cause a baby to be born with *fetal alcohol syndrome (FAS)* or *fetal alcohol effects (FAE)*, a pattern that can include intellectual disability, hyperactivity, head and face deformities, heart defects, and slow growth (Popova et al., 2017; Sunderman et al., 2019; Williams, Smith, & Committee on Substance Abuse, 2015). It has been estimated that in the overall population, approximately 1 to 3 of every 1,000 babies are born with FAS, and 30 of every 1,000 babies are born with FAE (Health Canada, 2005a).

Sedative-Hypnotic Drugs

At low dosages, **sedative-hypnotic drugs** produce feelings of relaxation and drowsiness. At higher dosages, they are sleep inducers, or hypnotics. *Benzodiazepines*, anti-anxiety drugs developed in the 1950s, are the most popular sedative-hypnotic drugs available today. Xanax®, Ativan®, and Valium® are three of the benzodiazepines in wide clinical use. In Canada there are no national prescription guidelines for this class of drug and use is relatively high compared with international use. Older adults are more likely to be prescribed these medications (Murphy, Wilson, Goldner, & Fischer, 2016).

> **sedative-hypnotic drugs** class of drugs that produces feelings of relaxation and drowsiness.

This group of drugs reduces anxiety without making people as overly drowsy as alcohol or other depressant substances. Nevertheless, in high enough doses, benzodiazepines can cause intoxication, and lead to addiction and even death. Research by Geoffrey Walton and colleagues, out of the University of British Columbia, found that benzodiazepine use by polysubstance users between 1996 and 2013 in Vancouver had a higher impact on their mortality than any other substance of abuse (Walton et al., 2016). Abuse of

benzodiazepines has also been found to impact overall health and the likelihood of engaging in unsafe sex in this population (Tucker et al., 2016). Researchers in Manitoba have found that in the general population, a segment of users (around 8 percent) escalate to using higher and higher levels of drug beyond the recommended dosage. This is often accomplished via "doctor hopping" and "pharmacy hopping" (Alessi-Severini et al., 2016). In older adults, the use of benzodiazepines has been linked to memory impairments and an increased risk of dementia disorders. Their use as a sleep aid for insomnia in older individuals needs to be tempered by these recent findings, however more research with larger numbers of older adults to determine how benzodiazepines may be increasing the risk of dementia in our elderly is needed (Pariente, de Gage, Moore, & Bégaud, 2016; Zhong, Wang, Zhang, & Zhao, 2015).

Opioids

The term **opioids** refers to *opium* and drugs derived from it, including *heroin*, *morphine*, *codeine*, and *OxyContin*. Natural opioids include morphine and codeine. Semi-natural or synthetic opioids that are created in laboratories from natural opioids include heroin, oxycodone, (brand name OxyContin), methadone, and fentanyl. Opium, a substance taken from the latex of the opium poppy, has been used for thousands of years. Opium dens, where a person could go and smoke the vapours of heated opium, were prevalent in many countries around the world (in Asia, Europe, and North America) in the early 19th century. Emily F. Murphy, police magistrate and judge in the Juvenile Court of Edmonton in 1922, was astonished to find that there was an illicit trade in narcotics across Canada that was affecting people of all ages. In her paper entitled "The Black Candle," she wrote that "men and women who batten and fatten on the agony of the unfortunate drug-addict—palmerworms and human caterpillars who should be trodden underfoot like the despicable grubs that they are" (Murphy, 1922, p. 7). In the past, opium was used widely in the treatment of medical disorders because of its ability to reduce both physical pain and emotional distress. Physicians eventually discovered, however, what was already known from the opium dens: prescription opium was as addictive as the illicitly available opium. Morphine, heroin and OxyContin, each of which was later derived from opium for use as a safer painkiller, also proved to be highly addictive. In fact, heroin is even more addictive than the other opioids since it more readily crosses the blood brain barrier than morphine and thus can have a greater effect on the brain and its reward systems.

> **opioids** class of drugs derived from the sap of the opium poppy.

Each of the various drugs that have been derived from opium has a different strength, speed of action, and tolerance level. Today, morphine, codeine, and in certain cases, like end-of-life cancer patients, fentanyl, are used as medical opioids, usually prescribed to relieve pain. Heroin is illegal in Canada under all circumstances.

Outside of medical settings, opioids are smoked, inhaled, snorted (inhaled through the nose), injected by needle just beneath the skin ("skin popped"), or injected directly into the blood stream ("mainlined"). An injection quickly produces a *rush*—a spasm of warmth and joy that is sometimes compared with an orgasm. The brief spasm is followed by several hours of a pleasant feeling and shift in consciousness called a *high* or *nod*. During a high, the

opioid user feels very relaxed and happy and is unconcerned about food or other bodily needs.

Opioids depress the central nervous system, particularly the brain areas that control emotion. The drugs attach to brain receptors that ordinarily receive a group of neurotransmitters called endorphins, that help reduce pain and emotional tension (Hart, Ksir, & Oakley 2010). When opioids bind to these receptors, the opioids produce the same kinds of pleasant and relaxing feelings, often at a more intense level, that endorphins would produce.

The most direct danger of heroin, and fentanyl, which has become more widely available as a street drug in Canada, is an overdose, which shuts down the respiratory centre in the brain, almost paralyzing breathing, and in many cases causing death. Death is particularly likely during sleep, when individuals cannot fight the respiratory effects by consciously working at breathing. A recent study by Tara Gomes and colleagues in Ontario looked at opioid-related deaths between 2013 and 2016. They found that over 30 percent of opioid-related deaths were in individuals with active prescriptions of opioids. The most commonly found non-prescribed opioid was fentanyl, which increased from being detected in 20 percent of opioid-related deaths in 2013 to 47.5 percent by 2016 (Gomes et al., 2018).

Withdrawal from opioids, and all of the drugs in the depressant class, can be severe. Individuals going through withdrawal often suffer from extreme chills, nausea, insomnia, muscle pain, and diarrhea among the psychological distress that can occur when the drug is no longer in their systems (Centre for Addiction and Mental Health, 2016). Treatment for opioid withdrawal symptoms is often done by substituting the opioid of choice (heroin) for a different opioid drug (methodone) at a low dose, which can help keep the cravings and withdrawal systems at a manageable level (Su, Lopez, Crossa, & Hoffman, 2018). (See Indigenous Experiences 6.2.)

6.2 Indigenous Experiences

Narratives Regarding Opioid Addiction in Indigenous Populations

Indigenous people (First Nations, Inuit, and Metis) are three times more likely to die from an opioid overdose than are non-Indigenous people (Belzak & Halverson, 2018). In spite of this statistic, Genevieve Johnston, at Carleton University, argues that the narrative in the Canadian news media regarding opioid deaths has been dominated by a focus on white middle-class (usually young) people portrayed as “innocent, normal, and victimized” versus Indigenous people who, when mentioned at all, are depicted as “addicted and hopeless” (Johnston, 2020, p. 128). In Johnston’s review of news sources, the number of stories focusing on young white victims versus Indigenous victims was 30 to 1. Mainstream news sources identified white youth as bright, middle-class, “good kids” who were immature and/or “duped” by unethical doctors or malicious drug dealers. These same sources typically did not single out Indigenous victims for individual recognition but instead “often implied that opioid addiction was a chronic community-based issue with no clear victim or villain” (p. 141).

Moreover, evidence suggests that most opioid overdoses occur from prescription opiates rather than illegal drugs. This is especially true of Indigenous communities,

where data clearly support the claim that Indigenous communities are prescribed a disproportionate number of opioid prescriptions. For example, one study indicated that for every 1,000 Indigenous persons over the age of 15, some 868 opioid prescriptions were prescribed (Webster, 2013) versus about 1 in 8 non-Indigenous people being prescribed opioids (Canadian Institute for Health Information, 2019). Another study from Alberta reported that 61 percent of Indigenous people who died from an overdose had filled an opioid prescription within 30 days of their death (Potkins, 2017).

Ignoring the serious opioid crisis among Indigenous peoples allows Indigenous people dying from opioid addiction to remain invisible. This, in turn, allows those in mainstream society to ignore the legacy of colonialism and systemic racism experienced by Indigenous people, and it allows Canadians to remain uninformed about the grave issues facing many people in these communities, including intergenerational trauma from residential schooling, inadequate housing, poverty, family violence, and mental health issues (Gone et al., 2019). As a consequence, Indigenous communities argue that healing needs to take the form of social cohesion through the reviving of traditional ways of life and "culture as treatment" (Johnston, 2020, p. 124).

THE CANADIAN PRESS/Darryl Dyck

Carrying the sorrow On International Overdose Awareness Day in Vancouver one woman comforts another at a memorial service remembering those who died of drug overdose.

"We are all family… we carry the sorrow," prominent Westbank First Nation Chief Roxanne Lindley said of the opioid crisis (Venn, 2019).

Critical Thinking Questions

How has the news media in Canada influenced Canadians' perceptions of opioid deaths in Indigenous versus non-Indigenous people?

What is more likely to lead to opioid overdoses - illegal or prescription drugs?

What impact does ignoring the opioid crisis in Indigenous people have on our understanding of Indigenous communities?

Stimulants

Psychoactive drugs that speed up the central nervous system are called **stimulants**. They produce increases in blood pressure, heart rate, alertness, thinking, and behaviour. The most common and often the most problematic stimulants are *caffeine*, *nicotine*, *cocaine*, and *amphetamines*.

stimulants substances that increase the activity of the central nervous system.

Caffeine

Caffeine, a mild (and legal) stimulant, is the world's most widely used stimulant. It is found in coffee, tea, chocolate, cola, and so-called *energy drinks*. Canada and the United States combined have the highest per-person consumption of caffeinated beverages in the world. In Canada, sales of caffeinated beverages is composed of roughly equal amounts of coffee and tea, followed by pop, sports and energy drinks (Reyes & Cornelis, 2018). Health Canada guidelines (2017) recommend that we don't consume more than 400 mg of caffeine per day, which is equal to the caffeine in about three cups (237 ml or 8 oz) of regular coffee. We challenge you to figure out how much caffeine you consume each day. (See **Table 6.4**.) Like many other psychoactive drugs, caffeine is addictive, although this addiction does not cause the significant social problems associated with substances such as alcohol, heroin, and cocaine (Meredith & Griffiths, 2015; Pomm et al., 2015). Still, quitting caffeine can cause unpleasant withdrawal symptoms for chronic users, including lethargy, sleepiness, anxiety, irritability, depression, constipation, and headaches. Withdrawal symptoms can start only a few hours after the individual's last consumption of caffeine.

Energy drinks are a relatively new way in which people are getting caffeine. Energy drinks contain very large amounts of caffeine and if not taken in moderation, can result in caffeine intoxication. (Red Bull cans have a label saying not to drink more than two.) In Canada, concerns have been raised about potential adverse effects of excessive caffeine consumption, via energy drinks, primarily in younger people. A recent Canadian study found that over 73 percent of the people surveyed between ages 12 and 24 have consumed energy drinks, with 16 percent of respondents stating that they have consumed more than two in one day (Reid et al., 2017). The heavy consumption of these beverages, as well as other caffeine-containing drinks, resulting in too much caffeine in one day, can lead to some unpleasant effects. Caffeine intoxication can involve restlessness, fidgetiness, nervousness,

excitement, euphoria, insomnia, flushing of the face, increased urination, gastrointestinal disturbance, muscle twitching, a rambling flow of thought and speech, irritability, irregular or rapid heartbeat, psychomotor agitation, and in very rare cases death (Banerjee, Ali, Levine, & Fowler, 2014; Bonsignore et al., 2014; Cappelletti, Daria, Sani, & Aromatario, 2015). If you notice any of these symptoms, check the amount of caffeine in the things you are drinking (remember cola beverages also have caffeine in them), and pace yourself a bit more carefully.

TABLE 6.4

Typical Amounts of Caffeine in Common Products

Source: "Caffeine," Centre for Addiction and Mental Health, https://www.camh.ca/en/health-info/mental-illness-and-addiction-index/caffeine.

Product	Typical Amount of Caffeine Contained
Cup* of brewed coffee	135 mg
Cup of instant coffee	76–106 mg
Cup of decaffeinated coffee	about 3 mg
Cup of tea	43 mg
Can of regular cola soft drink containing caffeine (355 ml)	36–50 mg
Can of energy drink (250 ml)	80 mg
Dark chocolate (28 g)	19 mg
Milk chocolate (28 g)	7 mg
Packet of hot chocolate mix	7 mg
Stay-awake pills	100 mg

* A cup is a small takeout cup size of 237 mL [8 oz]; coffee and tea are often served in much larger cups.

Nicotine

Although legal, *nicotine* is one of the most highly addictive substances (Compton, 2015). Most commonly, it is taken into the body by smoking tobacco. Nicotine is then absorbed through the respiratory tract, the mucous membranes of the nasal area, and the gastrointestinal tract. The drug proceeds to activate nicotine receptors located throughout the brain and body. Inhaling a puff of cigarette smoke delivers a dose of nicotine to the brain as quick as it could be delivered by injection into the blood stream. Interestingly, women are less likely than men to quit smoking. This may be related to the greater activation of the reward system (see end of chapter) in women than men, by nicotine (Beltz, Berenbaum, & Wilson, 2015).

Regular smokers, whether using traditional cigarettes or vapes, develop a tolerance for nicotine and must smoke more and more to achieve the same results (Kutlu, Parikh, &

Gould, 2015). When they try to stop smoking, they experience withdrawal symptoms such as irritability, increased appetite, sleep disturbances, and a powerful desire to smoke. Currently, the use of e-cigarettes is one strategy to withdraw from nicotine. Decreases in the amount of nicotine over time, using e-cigarettes, may help facilitate withdrawal, although it is not a foolproof way to quit nicotine (Benowitz, Donny, & Hatsukami, 2017; Lechner et al., 2015).

Almost one-fifth of all individuals over the age of 14 in Canada regularly smoke tobacco. Surveys also find that nearly 15 percent of all high school students smoke (Statistics Canada, 2016). All of this smoking eventually takes a heavy toll: 37,000 people in Canada die each year as a result of smoking. Chronic smoking is directly tied to lung disease, high blood pressure, coronary heart disease, cancer, stroke, and other fatal medical problems (Health Canada, 2011). Moreover, pregnant women who smoke are much more likely than non-smokers to deliver premature, underweight babies, and their babies are at a higher risk of death during their first year (Public Health Agency of Canada, 2016).

Cocaine

Cocaine, the key active ingredient of South America's coca plant, is the most powerful natural stimulant currently known. The drug was first separated from the plant in 1865. For many centuries, however, Indigenous people have chewed the leaves of the plant to raise their energy and increase their alertness. In the early twentieth century, cocaine was an ingredient in pain medication and some soft drinks (see the illustration).

© The Granger Collection, NYC

The early days **In the early twentieth century, cocaine was an ingredient in such products as Cocaine Toothache Drops and Coca-Cola soft drinks.**

Processed cocaine—a white, fluffy powder—is snorted and absorbed through the mucous membrane of the nose. Some users, however, prefer the more powerful effects of injecting cocaine intravenously or smoking it in a pipe or cigarette. Around 311,000 Canadians over 14 years of age used cocaine in 2010 (Health Canada, 2014).

Cocaine brings on a rush of euphoria and well-being—an orgasmic-like reaction if the dose

is high enough. Initially, cocaine stimulates the central nervous system, shifting users' levels of awareness and making them excited, energetic, and talkative. As more cocaine is taken, it stimulates additional areas of the central and peripheral nervous systems, resulting in increases in heart rate, blood pressure, breathing, arousal, and wakefulness. Cocaine apparently produces these effects largely by increasing activity of the neurotransmitter *dopamine* at key neurons throughout the brain (Ashok, Mizuno, Volkow, & Howes, 2017).

In both recreational and dependent cocaine users, memory, attention, and executive function (a person's ability to make decisions) is negatively affected (Vonmoos, et al., 2018). Regular use of cocaine may lead to a pattern of addiction. Tolerance to the drug may develop, and suddenly withdrawing from it results in depression, fatigue, sleep problems, anxiety, and irritability (Hart & Ksir, 2014).

Cocaine also poses serious physical dangers (Akerele & Nahar, 2015). Use of the drug in powerful, smokable forms, known as *freebasing* and *crack*, are the major contributors to the annual number of cocaine-related overdoses (McCall Jones, Baldwin, & Compton, 2017). Attempted suicide is more common in occasional and chronic cocaine users independent of other drug use (Artenie et al., 2015). A recent study from Montreal found that cocaine was a significant contributor to drug overdoses in the emergency rooms of two adult hospitals (Mikhail et al., 2019). The greatest danger of a cocaine overdose is its impairments of breathing and ability to cause major—even fatal—heart irregularities, or cause brain seizures (Liaudet, Calderari, & Pacher, 2014; Sordo et al., 2014).

Amphetamines

Amphetamines were first created in the late 1800s and are one of the few drugs discussed in this chapter that are purely synthetic and do not have a plant origin. Amphetamines have been used for a number of reasons, including attention deficit hyperactivity disorder, obesity, and narcolepsy. As recreational drugs, they are often used to heighten alertness, as an aphrodisiac, or as a performance enhancer for athletes (Simola & Carta, 2016). These stimulants are most often taken in pill or capsule form, although some individuals inject the drugs intravenously or smoke them for a quicker and more powerful effect. Like cocaine, amphetamines increase energy and alertness and lower appetite in small doses, produce intoxication and psychosis in higher doses, and cause an emotional letdown when they are broken down and cleared from the body. These drugs produce such effects by increasing the availability of the neurotransmitters *dopamine* and norepinephrine in the central nervous system. This greater availability allows for more dopamine and norepinephrine receptor activation of the neurons that are stimulated by these neurotransmitters, which in turn leads to activation of glutamate and opioid systems throughout the forebrain (Faraone, 2018; Haney, 2008).

Tolerance to amphetamines builds very rapidly, and the addiction potential of this class of drugs is high (Akerele & Nahar, 2015). People who start using the drug to help reduce their appetite, for example, may soon find they are as hungry as ever and increase their dose in response. Athletes who use amphetamines to increase their energy may also soon find that they need increasing amounts of the drug. When people who are addicted to the drug stop taking it, they may fall into a pattern of deep depression and extended sleep similar to the withdrawal from cocaine. Around 0.1 percent of the Canadian population uses

amphetamines (Health Canada, 2014).

One powerful kind of amphetamine, *methamphetamine* (nicknamed *crank* in one impure form or *crystal meth* in a more pure form), is available in the form of crystals (known as *ice* or *crystal meth*), which users smoke. Global methamphetamine use has been increasing and worldwide it is the second highest-used illicit drug (Stoneberg, Shukla, & Magness, 2017). According to the Canadian Centre on Substance Abuse and Addiction (2018), the prevalence of regular methamphetamine use in the general population is low at 0.2 percent, but higher in Canadian junior high and high school students (Grades 7 to 12) at 1.2 percent. Similar rates have been reported in post-secondary students. Some 3.9 percent of Canadians surveyed have admitted to using methamphetamine at least one during their lifetime.

Making and possessing methamphetamine is illegal across Canada. There have been increases in the seizure of methamphetamine in Alberta and Saskatchewan. Possession violations for methamphetamine have also increased, with British Columbia, Alberta, and Saskatchewan having the highest possession rates in Canada in 2017.

Most methamphetamine is made in small, illegal "stovetop laboratories," which typically operate for a few days and then move on to a new location (Hart et al., 2010). Although such laboratories have been around since the 1960s, they have increased eightfold over a recent decade. A major health concern is that these laboratories produce toxic fumes and due to the volatility of the chemicals used in creating methamphetamine, explosions of these laboratories are not uncommon (CCSA, 2018). Today, methamphetamine is also produced by large drug cartels. This has likely contributed to the increasing availability and use of methamphetamine worldwide (Gilbreath, 2015). Around 60 percent of current methamphetamine users are men (CCSA, 2018). The drug is particularly popular among biker gangs, in rural areas, and in urban gay communities. It is one of several drugs known as "designer drugs" that are used at parties, along with other drugs of choice such as alcohol (Lea, Reynolds, & de Wit, 2013).

Like other kinds of amphetamines, methamphetamine increases activity of the neurotransmitter dopamine, producing increased arousal, attention, and related effects. This particular drug also may damage nerve endings, a *neurotoxicity* that is compounded by the drug's tendency to remain in the brain and body for a long time—more than six hours (McConnell et al., 2015). Possible changes in the brain with chronic methamphetamine use include smaller frontal cortices; changes in white matter volume, which is an indication of changes in axon number; and changes in the connections between the frontal lobes and the basal ganglia as compared to controls. These differences may account for the behavioural changes seen in chronic methamphetamine users, such as poor decision making, increased impulsivity, loss of cognitive flexibility, and increased aggression (Kogachi et al., 2017; Lederer et al., 2016; London, Kohno, Morales, & Ballard, 2015). But, among users, such dangers are less important than methamphetamine's immediate positive impact, including perceptions by many that it makes them feel hypersexual and uninhibited (Hittner, 2016; Hoenigl et al., 2016). All of this has contributed to major public health problems. For example, trading methamphetamine for sex is a significant factor for the spread of HIV among men who have sex with men (Semple, Strathdee, Zians, & Patterson, 2010). Similarly, increases in domestic-violence incidents, assaults, and robberies have been tied to the use of methamphetamine (McKetin et al., 2014; Watt et al., 2017). A likely

explanation for these findings links back to the effects of methamphetamine, where increased arousal leads to increased sexual activity and/or violence, and in some cases methamphetamine-induced psychosis (Lederer et al., 2016; McKetin et al., 2017).

Methylenedioxymethamphetamine, or MDMA (better known as ecstasy), is another "club drug" form of methamphetamine often found at parties. Just over a half of one percent of Canadians have tried ecstasy (Health Canada, 2014). Ecstasy produces its effects by causing a dump of the serotonin neurotransmitter, which then binds to serotonin receptors and activates the neurons downstream of serotonin. The result is a sense of euphoria, reduced anxiety, and increased social intimacy lasting for two to four hours. This outpouring of serotonin initiated by ecstasy means that if one takes more of the drug when the effects of the initial dose wear off, there is very little additional effect. Short-term issues can include dehydration, difficulty concentrating, lack of appetite, and dry mouth. Longer-term negative effects can include depression, anxiety, paranoia, and memory and cognitive problems, as well as long-term damage to the serotonin system (Parrott, 2012, 2013).

Hallucinogens

Hallucinogens, or *psychedelic drugs*, are substances that dramatically change one's state of awareness by causing powerful changes in sensory perception, such as enhancing a person's normal perceptions and producing illusions and hallucinations. This class of drugs is the only group that has the ability to alter our consciousness and perception of the world around us in a dramatic fashion where the distinction between our internal and external worlds can be blurred and our brain's ability to perceive reality is no longer reliable. The substance-induced sensory changes are sometimes called "trips," and these trips may be exciting or frightening, depending on how a person's brain reacts to the drugs. Many hallucinogens come from plants or animals; others are laboratory-produced. The most common hallucinogens include LSD, psilocybin (magic mushrooms), mescaline (peyote cactus), ketamine, phencyclidine (PCP), and N, N-dimethyltriptamine (DMT).

> **hallucinogens** substances that dramatically change one's state of awareness, causing powerful changes in sensory perception.

LSD

Lysergic acid diethylamide, or *LSD*, is a powerful hallucinogen that was derived by the Swiss chemist Albert Hoffman in 1938 from a group of naturally-occurring substances. During the 1960s, a period of social rebellion and experimentation, millions of users turned to the drug in an effort to raise their consciousness and expand their experiences. Within two hours of being swallowed, LSD brings on *hallucinosis*, a state marked by a strengthening of visual perceptions and profound psychological and physical changes. People may focus on small details—each hair on the skin, for example. Colours may seem brighter or take on a shade of purple. Users often experience illusions in which objects seem distorted and seem to move, breathe, or change shape. LSD can also produce strong emotions, from joy to anxiety or depression. Past thoughts and feelings may return. All these effects take place while the user is fully alert, and wear off in about six hours. Scientists believe that LSD produces these effects primarily by binding to receptors on many of the neurons that

normally bind the neurotransmitter *serotonin*, changing neuronal activity at those sites. Recent imaging studies of the brain while experiencing LSD show a large increase in visual cortex activity. The connections from visual cortex to the rest of the brain were also more active, possibly explaining the visual hallucinations many people experience with this drug (Carhart-Harris et al., 2016b). The experience of music under LSD is also different than without the drug onboard. Brain activity in areas that process sound and the activity of the connections between these areas and areas of the brain involved in emotion are enhanced. This may be why listening to music during an LSD experience is often filled with wonder, bliss, and a transcendent experience (Kaelen et al., 2015).

Source: KatarzynaBialasiewicz/iStock/Getty Images

Bad trip **Ingesting LSD can bring on hallucinosis, a state of sensory and perceptual distortions. Sometimes this state can be very frightening and disorienting, as captured in this photo illustration of a hallucination of hands and arms burning.**

About 1 percent of all people in Canada have used LSD or another hallucinogen over the past year (Health Canada, 2014). LSD is so powerful that any dose, no matter how small, is likely to produce very strong reactions. Sometimes the reactions are quite unpleasant, an experience called a "bad trip" (see the photo). In addition, some LSD users have **flashbacks**, recurrences of the sensory and emotional changes even after the LSD has left the body. Current research on flashbacks, also referred to as hallucinogen persisting perception disorder, is limited. However, there is some suggestion that these long-term lingering effects of LSD and other psychedelics on altered perceptual experiences may be partially related to pre-existing psychiatric conditions in individuals who report flashback-like experiences (Halpern, Lerner, & Passie, 2016).

flashbacks recurrence of the sensory and emotional changes after the LSD has left the body.

Initial research in the 1950s suggested that LSD had the potential to be a powerful therapeutic agent for a variety of psychological illnesses. When this group of drugs was

brought under the umbrella of drugs of abuse in the 1970s, research looking at the therapeutic uses of hallucinogens was halted. In the last two decades, scientists and therapists have again been exploring the use of hallucinogens for the treatment of psychological disorders. With the resurgence of research in this area, what has become clear is that the patient-clinician relationship, the physical environment where treatment occurs, and the expectations of the client and clinician from these drug treatments are critical to consider in conjunction with the effects of the drug being tested (Tupper, Wood, Yensen, & Johnson, 2015). In a therapeutic setting, LSD has shown promise for decreasing anxiety in patients with life-threatening diseases, drug dependence, and depression, among other psychological disorders, similar to several of the drugs discussed in the next few sections. The hallucinogenic class of drugs may have great therapeutic potential as we move forward in the treatment and understanding of several psychological illnesses (Gasser, Kirchner, & Passie, 2015; Sessa & Johnson, 2015).

Psilocybin

Also known as "magic mushrooms" or "shrooms," psilocybin is the active chemical found in several species of mushrooms that grow naturally in areas of South America, Mexico, and the southern United States. Historically these mushrooms have been used for centuries to facilitate mystical experiences (Guzmán, 2008; NIDA, 2019). Psilocybin, when metabolized in the body to its active chemical form called psilocin, works on the serotonin system (Lee & Roth, 2012). It is a compound of interest for researchers and therapists due to psilocybin's ability to decrease anxiety and leave users with a feeling of having a mystical type of experience that is accompanied by persisting positive improvements in mood, attitudes, and behaviour for up to 14 months after the drug experience (Griffiths et al., 2011). The experience of users, however, can be impacted by their prior mental state, or personality traits, as the drug effects begin to peak. For example, individuals who rate high on emotional excitability report less pleasant experiences with this drug than those who do not report high emotional excitability (Studerus, Gamma, Kometer, & Vollenweider, 2012). In therapeutic settings, this drug has been used to decrease anxiety in cancer patients, help individuals stop smoking, and improve symptoms in individuals with treatment-resistant depression, with positive effects still present six months after exposure to psilocybin (Carhart-Harris et al., 2016, 2017; Johnson, Garcia-Romeu, & Griffiths, 2017; Johnson & Griffiths, 2017).

Mescaline

This drug is naturally present in a small spineless cactus, but can also be produced synthetically (NIDA, 2019) and is more commonly called "buttons" or "mesc." In the late 1800s, mescaline, the active compound found in the peyote cactus, was synthesized in a laboratory setting and became more widely available for use. Similar to other psychedelics, this drug binds primarily to serotonin receptors to facilitate the hallucinogenic experiences of its users (Cassels & Sáez-Briones, 2018). The effects of this drug are similar to those of LSD and psilocybin with euphoria, hallucinations, and a sense of depersonalization, or a detachment from one's self or body being the most common. Again, similar to LSD and psilocybin, addiction and dependence are uncommon with this drug, and it is of interest for its therapeutic potential for psychological disorders. However, at present much less is known about its potential uses than for psilocybin (Dinis-Oliveira, Pereira, & da Silva,

2019).

N, N-dimethyltryptamine (DMT)

This is a compound that can be found naturally in select plants that grow in the Amazon forest (NIDA, 2019). Ayahuasca tea is commonly made by local individuals from these plants and this tea is used in Ayahuasca ceremonies for enlightenment. DMT can also be synthesized in a laboratory and interestingly, it is found in the pineal gland of the brain. The amounts produced by the pineal gland, however, are too low to produce psychoactive or hallucinogenic effects in the brain (Nichols, 2018).

Ayahausca travel tours for North Americans, where individuals go to South America to participate in an Ayahuasca ceremony, have become increasingly common over the last decade. Individuals who are willing to travel for these ceremonies have been found to score higher on the personality traits of optimism, ambition, and helpfulness, and lower on distrust, which all makes sense! It is unsurprising that these personality traits exist in a person who is willing to pay to travel from Canada to South America to try a psychoactive drug they may have no experience with, can't be sure of the purity of, and don't know if it will make them sick (Kavenská & Simonová, 2015; Tupper, 2011).

In Canada, a recent study from British Columbia has shown that the incorporation of expert-led Ayahausca ceremonies into a four-day group counselling session with a rural First Nations community in B.C. was part of a program that led to self-reported declines in alcohol, cocaine, and tobacco use (Thomas et al., 2013). More research is warranted but the initial research is promising.

Interestingly, the chemical structure of DMT can be found within the chemical structure of psychedelics such as LSD and psilocybin, and may be a contributing factor to the hallucinogenic effects of these drugs (Cameron & Olson, 2018). Like the other hallucinogens, DMT's psychedelic effects are primarily due to the activation of serotonin receptors. Visual hallucinations, distortion of body image, speech disturbances, and changes in mood have all been reported with DMT exposure, similar to LSD and psilocybin. There has been renewed interest in the use of DMT as a therapeutic drug for the treatment of anxiety, depression, and post-traumatic stress disorder, but more research is needed (Barker, 2018).

Ketamine

This drug is commonly used as an anaesthetic in veterinary clinics. Ketamine available on the street often comes from veterinary clinics and is known by alternative names such as "special K" and "cat valium." In addition to its hallucinogenic properties, it can disrupt memory and has been used to enable sexual assault (NIDA, 2019). Ketamine often produces auditory and musical hallucinations in addition to its alterations of colour perception, reaction time, and sense of time in general (Bokor & Anderson, 2014; Powers III et al., 2015). Ketamine works primarily via its effects on receptors that would normally bind glutamate, the major excitatory neurotransmitter found throughout the brain. The auditory hallucinations produced with ketamine have been of particular interest for scientists as a way to model and study the auditory hallucinations that often accompany phases of acute schizophrenia (more on this in Chapter 15). Experiments with healthy subjects exploring how the brain creates these auditory hallucinations while under the effect of ketamine are

ongoing (Frolich & Van Horn, 2014; Thiebes et al., 2018).

Phenylcyclidine (PCP)

PCP was developed as a potential anesthetic for general surgery in the early 1950s, similar to the development of ketamine, but was discontinued after it was found that there are serious side effects. It is currently available as a street drug and often goes by the names of "angel dust," "love boat," or the "peace pill" (NIDA, 2019). PCP acts on the brain in a similar way to ketamine by activating receptors that normally bind glutamate (Lodge & Mercier, 2015). The excitatory effect of PCP on the brain can lead to PCP intoxication. Symptoms of PCP intoxication can include psychomotor agitation, repetitive and uncontrolled movement of the eyes, heightened agitation, and after the drug wears off, amnesia for what occurred while under the influence of PCP (Dominici et al., 2015). PCP use has been associated with higher levels of intimate partner violence and violence in general, although the causal aspect of this relationship warrants further study (Crane, Easton, & Devine, 2013; Belenko & Spohn, 2014).

Cannabis

Cannabis plants have been used for millennia. Restrictions on its use were put in place in North America in the early 20th century. However, these restrictions have been lifted in several countries around the world, including Canada (see Psychology Around Us 6.2). Cannabis, or more importantly the psychoactive compound Δ9-THC that is found in cannabis, can be categorized as a depressant, stimulant, and hallucinogenic drug depending on the experience of the user. Collectively, the drugs produced from varieties of hemp plants are called *cannabis*. The best-known form of cannabis, *marijuana*, is a mixture derived from the buds, crushed leaves, and flowering tops of hemp plants that is rolled and then smoked. Hashish is also made from the cannabis plant, specifically the resin. This resin is often inhaled after heating in a bong or vaporizer but can be incorporated with the leaves and buds of the plant in a joint for smoking.

There are several hundred active chemicals in cannabis, however, *Δ9-tetrahydrocannabinol* (*THC*) is the one most responsible for its effects. The greater the THC content, the more power ful the cannabis. Due to the forced evolution, or selective breeding, of cannabis plants, the amount of THC in resin cannabis products have increased from 10 percent in 2009 to 23 percent in 2016. For herbal cannabis, the concentration of THC has risen from 2 percent in 1995 to 7 percent in 2009 and 13 percent in 2015 (Dujourdy & Besacier, 2017). THC works by binding to cannabinoid receptors which are found throughout the brain. Activation of this receptor system is responsible, in turn, for changing the activity of other neurotransmitter systems such as the dopamine and opioid systems (Vemuri & Makriyannis, 2015).

At low doses, a person who smokes or ingests THC typically has feelings of happiness and relaxation, although some individuals may become anxious or irritated, especially if they have been in a bad mood. Many users have sharpened perceptions and become fascinated with the intensified sounds and sights that they are experiencing. Time seems to slow down, and distances and sizes become greater. This overall reaction is often called getting "high." In some individuals, cannabis produces particularly unusual visual experiences, changes in body image, and even hallucinations (Martin-Santos et al., 2012; Sewell et al.,

2013). Most of the drug's effects last 2 to 6 hours.

Because THC can interfere with complex sensorimotor tasks and cognitive functioning, it can impair performance on tasks such as driving (Del Balzo et al., 2018; Downey et al., 2013). In addition, many people using THC fail to remember information, especially recently learned material. THC or marijuana users, especially those who are chronic users and start using early, before the age of 16, may function poorly at school or work (Ehrler, McGlade, & Yurgelun-Todd, 2015; Schuster, Hoeppner, Evins, & Gilman, 2016). Some research also suggests that regular marijuana smoking or THC use may contribute to long-term medical problems, including lung disease (Tashkin, 2018; NIDA, 2011), lower sperm counts in men, and abnormal ovulation in women (Gundersen et al., 2015; Ilnitsky & Van Uum, 2019). However, marijuana has been found to have medicinal benefits, which in part led to its legalization for medicinal and recreational use in Canada. (See Psychology Around Us 6.2.)

Peter Fried in the Department of Psychology at Carleton University has been running longitudinal studies into the effects of prenatal exposure to marijuana and cigarette smoke (as part of the Ottawa Prenatal Prospective Study) and the effects of marijuana use in the teenage years on IQ scores in the young adult years. Fried's work suggests that prenatal exposure to marijuana shows negative impacts on response inhibition or behavioural self-control (Smith, Fried, Hogan, & Cameron, 2004; Smith et al., 2011, 2016) and on working memory (Smith, Fried, Hogan, & Cameron, 2006; Smith et al., 2010) in adolescence, even when the effects of marijuana use by the participating teenagers themselves was controlled for. In terms of IQ, Fried compared IQ scores at 9 to 12 years of age with those at 17 to 20 years of age for teenagers who were heavy users (five joints per week), light users, former users, or non-users of marijuana. The results were dose-related, with heavy users showing on average about a 4-point drop in IQ scores, while others showed increases in IQ scores ranging from 3 to about 6 IQ points over the same period (Fried, Watkinson, James, & Gray, 2002; Roten, Baker, & Gray, 2015).

6.2 Psychology Around Us | Positive Psychology

Marijuana as Medicine

While most of us are aware of the use of marijuana (cannabis) as a recreational drug, could there actually be medical reasons to use it? Cannabis contains over 500 compounds, which fall into the categories of cannabinoids, flavonoids, and terpenoids. The two main compounds that are the most abundant in cannabis are the cannabinoids delta-9-tetrahydrocannabinol (THC) and cannabidiol (CBD). THC is the storied psychoactive compound that produces the "high," while CBD is a non-psychoactive compound that has been revealed to have some intriguing properties regarding health (Bridgeman & Abazia, 2017; Hoggart et al., 2015; Linher-Melville et al., 2020).

Despite what some politicians have said in the past—that cannabis has no medical use—cannabis has likely been used medicinally for hundreds if not thousands of years. Since 1982 in Canada, synthetic THC has been used in oncology (cancer) units in hospitals across the country to treat nausea and to increase appetite after

chemotherapy. Synthetic THC is also used as an adjunct for pain management, especially in cases of intractable and neuropathic pain (Kosiba, Maisto, & Ditre, 2019).

In 2001, Health Canada introduced the Marijuana for Medical Purposes Regulations, which made it possible for people with certain health conditions to use cannabis to treat their symptoms. Further, in 2014 Health Canada introduced the Access to Cannabis for Medical Purposes Regulations. Under those new regulations, patients could obtain a prescription for medical cannabis from their doctor, whereas they previously had to apply to Health Canada for permission to obtain and use medical cannabis. As well, under the new regulations, only licensed commercial producers can legally grow cannabis and sell it directly to patients with prescriptions. Previously patients were permitted to grow their own marijuana for medical use. This change may make it difficult for some patients to get the strain of marijuana they have found to be most beneficial for treating their condition(s).

THC has improved the lives of many with neuropathic pain, anxiety disorders, and other types of chronic conditions. Studies also show that the use of THC can reduce the amounts of opiates used by pain sufferers. THC can also improve movement disorders related to Parkinson's disease, help with insomnia, improve appetite, and treat glaucoma. Studies are ongoing as scientists find more beneficial uses of this age-old drug (Junior, dos-Santos-Pereira, Guimaraes, & Del Bel, 2020).

The other dominant drug found in cannabis, cannabidiol (CBD), has been found to be effective in treating individuals with seizure disorders who don't respond to other anti-seizure medication (Szaflarski et al., 2019). In fact, in some children having hundreds of seizures a day, CBD can reduce their seizures dramatically down to only a handful a day (Huntsman et al., 2019). CBD has also been found to be effective in reducing use of opiates in patients with chronic pain and can be effective on its own for chronic mild pain. One of the more surprising findings is that CBD acts as an anti-inflammatory and can help those with conditions such as inflammatory bowel disease.

The legalization of cannabis in Canada in 2017 opened further opportunities to study the effectiveness of THC, CBD, and the host of other cannabinoids in cannabis to assess their action in numerous medical conditions. These compounds no longer require special government licenses for their use in research making it easier for medical research assessing their potential uses on our health, including our mental health.

Jonathan Heyward / The Canadian Press

Cannabis as medicine **Cannabis and cannabis-derived medicines have been proven to be effective in treatments for conditions such as glaucoma, chronic pain, and epilepsy.**

Because of the higher THC content in marijuana grown today, many people are now caught in a pattern of heavy and regular use, getting high on marijuana daily, although it is not clear whether such use represents a true addiction or a strong habit (Smith, 2016). In addition, those who use marijuana as well as other drugs such as alcohol find it more difficult to abstain from drug and alcohol use (Mojarrad et al., 2014). Either way, a number of marijuana and THC users do indeed find their social, occupational, or academic lives greatly affected. Around 10 percent of people in Canada have used marijuana in the past year; just over 40 percent have used it at some point in their lives (Health Canada, 2014).

The Effect of Psychoactive Drugs on the Brain

Based on what you've read in the preceding section, all psychoactive drugs increase the activity of certain neurotransmitters in the brain—neurotransmitters whose typical function is to reduce pain, calm us or lift our mood. Alcohol, for example, heightens activity of the neurotransmitter *GABA*; opioids raise *endorphin* activity; and cocaine and amphetamines increase *dopamine* activity.

It used to be thought that each drug, along with its corresponding neurotransmitters, sets in motion a unique set of brain reactions. However, recent brain-imaging studies suggest that while each drug has its own starting point in the brain, most (perhaps all) of them eventually activate a single **reward learning pathway**, or "pleasure pathway," in the brain (Koob, 2016; Volkow, Wise, & Baler, 2017) (see **Figure 6.12**). The reward learning pathway is activated by pleasurable stimuli or events and comes to anticipate (and thus motivate action toward) the arrival of desirable food, sexual experiences, or other pleasurable or rewarding experiences (Volkow, Wise, & Baler, 2017). This brain reward learning pathway extends from the midbrain to the nucleus accumbens and on to the

frontal cortex (see Chapter 3).

> **reward learning pathway** brain circuitry that is important for learning about rewarding stimuli.

The key neurotransmitter in this pathway is *dopamine*. When a person wants—at times, even craves—pleasurable rewards, such as music, a hug, or, for some people, a drug it often leads to a release of dopamine in this pathway (Dubol et al., 2018; Volkow, Wise, and Baler, 2017). Certain drugs apparently stimulate the reward learning pathway directly. You will recall that cocaine and amphetamines directly increase dopamine activity. Other drugs seem to stimulate it in roundabout ways. The biochemical reactions triggered by alcohol and opioids each set in motion a series of chemical events that eventually lead to increased dopamine activity in the reward learning pathway.

Research also suggests that people prone to abuse drugs may suffer from a **reward-deficiency syndrome**—the neurotransmitters that make up the reward pathway are not active at levels that are typical of many of us and are not activated readily by the events in their lives (Blum et al., 2015; Febo et al., 2017). These individuals may be more inclined than others to turn to drugs to stimulate this reward system (Blum et al., 2017; see Figure 6.12). Variations in gene composition and expression have been studied as a possible cause of this syndrome (Blum et al., 2015).

> **reward-deficiency syndrome** theory that people might abuse drugs because their reward centre is not readily activated by usual life events.

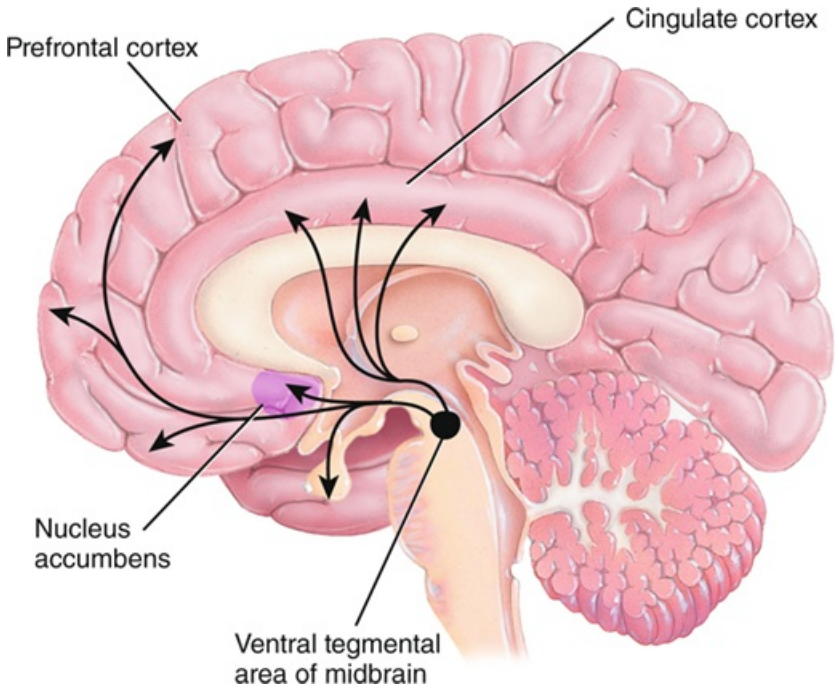


FIGURE 6.12 Reward learning pathway **The brain's reward learning pathway, or "pleasure pathway," extends from an area in the midbrain called the ventral**

tegmental area to the nucleus accumbens, as well as to the prefrontal cortex.

But how do people become caught in a broad pattern of addiction, marked by tolerance and withdrawal effects? One possible explanation is that when a person takes a particular drug chronically, the brain eventually makes an adjustment and alters its typical levels of production of the neurotransmitter whose activity is being changed by the drug of choice (Hirvonen et al., 2012; Ozdemir, 2017; Vinkers & Olivier, 2012). As drug intake increases, the body's production of the neurotransmitter continues to change, often decreasing in output, in response to the drug that is taken. The individual needs to take more and more of the drug to feel its positive effects. In short, with drug use, people are building tolerance for a drug, becoming more and more dependent on it, rather than on their own biological processes. In addition, if they suddenly stop taking the drug, their own levels of neurotransmitters are often low, producing symptoms of withdrawal that will continue until the brain resumes a new level of normal production of neurotransmitters like GABA, endorphins or dopamine.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

11. What are the major drug categories and the characteristics of each category?

12. What is addiction, and what are two key features of addiction to a drug?

13. Why is alcoholism relatively less common among Asians than in individuals of other ethnic groups?

What Do You Think? • Why do you think alcohol is more acceptable culturally than some of the other drugs we are discussing here?

Summary

When We Are Awake: Conscious Awareness

LEARNING OBJECTIVE 1 Define different levels of conscious awareness and describe key brain structures and functions associated with those levels.

Attention is one of the key aspects of conscious awareness. Other key cognitive activities underlying cognitive awareness include monitoring (our implicit decisions about what to attend to), memory, and planning.

Most biological psychologists believe that consciousness results from a combination of brain activities across several brain regions. Three key brain structures appear to be the cerebral cortex, which helps regulate our awareness of attentional processes, the thalamus, which relays sensory information from various parts of the brain to the cerebral cortex for processing and the reticular formation, which is important for keeping the cortex, and relevant subcortical structures, awake and alert.

When We Are Awake: Preconscious and Unconscious States

LEARNING OBJECTIVE 2 Summarize the ideas of preconscious and unconscious states, including Freud's thinking on the unconscious.

In addition to our conscious level of awareness, many psychologists believe there are other levels or degrees of consciousness, and distinguish conscious awareness from two other states—unconsciousness and preconsciousness.

Cognitive psychologists have demonstrated the existence of implicit memory; that is, memory that we do not consciously reflect upon but which, nevertheless, influences our behaviour.

Preconsciousness is a level of awareness in which information can become readily available to consciousness if necessary.

Unconsciousness is a state in which information is not easily accessible to conscious awareness.

Freud viewed the human unconscious as an important storehouse for knowledge and experience, which although not directly accessible to our conscious awareness, still influences our behaviour.

Although Freud's ideas fell into disfavour for several years, in recent years scientists have begun to re-examine the unconscious from different points of view. For example, implicit memory describes knowledge that we have and are able to apply to various tasks, without being able to recall it at will.

When We Are Asleep

LEARNING OBJECTIVE 3 Describe sleep, key theories of why we sleep and dream, and problems with sleep and how they affect functioning.

Every 90 to 100 minutes when we sleep, we pass through a sleep cycle consisting of five different stages. The fifth stage of sleep, rapid eye movement, or REM sleep, is characterized by rapid and jagged brainwave patterns and eye movements and irregularities in heart rate and breathing. Dreaming usually occurs during this phase of sleep.

Scientists have identified brain activities that maintain the regular rhythms of life. Our move from a sustained period of wakefulness into a period of sleep during each 24-hour period is known as a *circadian rhythm*.

Scientists have not reached a definitive conclusion about why people sleep, although some scientists have suggested sleep serves an evolutionarily adaptive function, keeping our ancestors away from predators that hunted at night. Others have suggested that sleep might play a role in growth, or is important for the rehearsal and storage of new information that we have learned throughout the previous day.

We also do not understand why people dream. Recent theories about dreams emphasize cognitive approaches. The information-processing theory of dreams suggests that dreams are the mind's attempt to sort out and organize the day's experiences and fix them in memory. The attention-synthesis hypothesis suggests that

dreams are the mind's attempts to give meaning to internally generated signals firing throughout the brain during deep sleep. Freud believed that dreams represent expressions of the internal desires and wishes that have been repressed and stored in the unconscious.

Sleep deprivation can lead to feelings of fatigue, irritability, and malaise, resulting in lower productivity and a tendency to make mistakes. Loss of sleep can also affect the functioning of the immune system. The regular inability to fall asleep or stay asleep is called insomnia. Other sleep disorders include sleep apnea, narcolepsy, sleepwalking, and night terrors.

Altered States of Consciousness: Hypnosis

LEARNING OBJECTIVE 4 Discuss theories and evidence about what hypnosis is, how it works, and how it can be used.

Hypnosis is a suggestible state during which people can be directed to act in unusual ways, experience unusual sensations, remember forgotten events, or forget remembered events.

Ernest Hilgard's theory suggests that hypnosis divides consciousness into two parts: one focused on the suggestions of the hypnotist, and the other a hidden observer. Other theorists suggest that motivated role-playing is at work in hypnosis.

Hypnosis has been used to successfully help control pain, as well as treat anxiety, skin diseases, asthma, insomnia, stuttering, high blood pressure, warts, and other forms of infection.

Altered States of Consciousness: Psychoactive Drugs

LEARNING OBJECTIVE 5 List and describe common depressant, stimulant, and hallucinogenic psychoactive drugs and their effects.

The main classes of psychoactive drugs are depressants (substances that slow down brain activity), stimulants (substances that excite brain activity), opioids (substances that attach to brain receptors that ordinarily receive endorphins), and psychedelic or hallucinogenic drugs (substances that distort sensory perceptions).

Regular ingestion of some drugs can lead to maladaptive changes in a person's behaviour patterns and physical responses, a pattern known as *addiction*. Signs of addiction can include increased tolerance for a particular drug, the need for larger and larger doses of a substance to get the desired effect, and symptoms of withdrawal when one discontinues the drug.

A list of several psychoactive drugs and their effects is in Table 6.2.

Key Terms

activation-synthesis model

adaptive theory of sleep

addiction
alcoholism
altered states of consciousness
circadian rhythm
consciousness
contents of consciousness
depressants
dissociation
flashbacks
hallucinogens
hypnagogic state
hypnosis
information-processing theory
insomnia
lucid dreams
narcolepsy
non-REM sleep (NREM)
opioids
preconsciousness
psychoactive drugs
rapid eye movement sleep (REM)
restorative theory of sleep
reward-deficiency syndrome
reward learning pathway
sedative-hypnotic drugs
sleep apnea
sleep spindles
states of consciousness
stimulants
suprachiasmatic nucleus (SCN)
tolerance
unconscious state
withdrawal symptoms

Self-Study Questions

Multiple Choice

1. Which of the following statements best expresses the relationship between attention and consciousness?

a. Attention is a product of consciousness.

b. Attention is necessary for consciousness.

c. Attention is sufficient for consciousness.

d. Attention is the same as consciousness.

2. Which subcortical structure in the brain is especially important for consciousness?

a. amygdala

b. hippocampus

c. cerebellum

d. thalamus

3. Information of which you are currently unaware but which you can bring to mind quite easily is said to be in the _____.

a. preconscious

b. protoconscious

c. subconscious

d. unconscious

4. Freud suggested that most of one's personal knowledge is contained in the _____.

a. conscious mind

b. preconscious

c. subconscious

d. unconscious

5. Mental perceptions that do not match the stimulation coming from the environment are called _____.

a. delusions

b. distortions

c. hallucinations

d. illusions

6. The structure in the hypothalamus that coordinates the function of the pineal gland producing melatonin is the _____.

a. pons

b. prefrontal cortex

c. reticular formation

d. suprachiasmatic nucleus

7. REM sleep is sometimes called "paradoxical sleep" because:

a. both the brain and the body are inactive.

b. the brain is active, but the major skeletal muscles are paralyzed.

c. the brain is less active than it is during other sleep stages.

d. the skeletal muscles remain active, but the brain is inactive.

8. Ethyl alcohol exerts its effects by primarily influencing which of the following neurotransmitters?

a. acetylcholine

b. endorphins

c. GABA

d. serotonin

9. The reward learning pathway in the brain can be activated by:

a. cocaine only.

b. hypnosis and meditation only.

c. psychoactive drugs only.

d. any activity or substance the individual finds to be pleasurable.

10. Sleep related breathing disorders are characterized by:

a. breathing too quickly

b. loss of a signal from the brain to the body to breathe

c. sleeping in a room that is too bright

d. an inability to fall asleep in a cold room

Fill-in-the-Blank

1. Patients studied by Weiskrantz demonstrated a phenomenon called _____ that led them to navigate around objects in a room but claim to see nothing.

2. The memory system that gets strengthened mainly by repeated practice, rather than through conscious attention, is called _____ memory.

3. Psychologists often use hypnosis to reduce an individual's awareness of pain; this procedure attempts to induce _____ hallucinations.

4. According to Freud, the portion of our dreams that we can recall upon waking (and that is often symbolic of the hidden, unconscious portion) is called the _____ content.

5. Biological processes occurring on a cycle of approximately 24 hours are termed _____ rhythms.

6. Two of the sleep disorders that tend to occur during Stages 3 and 4 of NREM sleep are _____ and night terror disorder.

7. Continued use of psychoactive drugs can lead an individual to need more and more of the drug to get the expected effect, a tendency known as _____.

8. Most psychoactive drugs affect the brain by activating a common pathway, whose key neurotransmitter is _____.

9. In those addicted to amphetamines, abruptly stopping the drug causes a painful withdrawal process that is very similar to withdrawal from _____.

10. The structures that seem to be key for consciousness are _____, _____, and _____.

CHAPTER 7
Learning

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CHAPTER OUTLINE

What Is Learning?

LEARNING OBJECTIVE 1 Define learning and distinguish between associative and non-associative learning.

Classical Conditioning

LEARNING OBJECTIVE 2 Describe the basic processes of classical conditioning and explain how classical conditioning is relevant to learning.

Operant Conditioning

LEARNING OBJECTIVE 3 Describe the basic processes of operant conditioning and explain how shaping can be used to teach new behaviours.

Observational Learning

LEARNING OBJECTIVE 4 Define observational learning and summarize concerns about observational learning from the media.

Learning and Cognition

LEARNING OBJECTIVE 5 Define spatial navigation learning, implicit and latent learning, and insight learning.

Factors that Facilitate Learning

LEARNING OBJECTIVE 6 Define massed and spaced practice and tell what conditions are best for learning semantic material, such as facts in your classes.

Prenatal and Postnatal Learning

LEARNING OBJECTIVE 7 Summarize the types of learning that occur before we are born and during early postnatal life.

Specific Learning Disorder

LEARNING OBJECTIVE 8 Define specific learning disorder and describe three major types of learning disorders.

Mei was to start university in September. But due to the COVID-19 pandemic, her university is offering only remote teaching. Mei is disappointed, but she is also very anxious. She is worried about how she will juggle her courses without in-class instruction. She also misses seeing her friends. Mei lives with an elderly grandfather and so must mostly isolate. She also finds herself inexplicably thinking about her favourite aunt, who has been dead for five years; Mei cannot understand why these thoughts of her aunt have reemerged after all this time and this worries her. To accommodate her newly widowed grandfather, just as the pandemic began, Mei's family moved to a new house. When Mei first moved into the house, her grandfather's nighttime wandering kept her awake, but now this no longer bothers her. Mei worries that this may mean that she is not as alert as she should be. As well, the weather has been unusual, with thunder and lightning storms blowing in without much warning. At the beginning of the pandemic, Mei took regular walks to stay active and to get a break from the house. But once when out for a walk, she was unexpectedly caught outside in a sudden storm. She was concerned that she might be struck by lightning, so is now apprehensive that she might get caught outside during a storm again. Instead, she stays inside the house, cooped up in her room. Mei's older sister, Yenay, noticed that Mei is becoming increasingly withdrawn and is concerned about her. Yenay, in her third year at university and a very successful student with high grades, offers to help Mei with her courses in the fall if Mei will start taking regular walks with her and if Mei will agree to leave her room and spend time with the family. Mei reluctantly agrees because she is very concerned about school in the fall.

As we will see in this chapter, learning situations are influenced by many variables, including how difficult the learning task is, how much attention the learner is paying to the task, what sorts and levels of emotions are involved, and whether any required biological precursors to learning are in place—to name a few. The study of each will come up later in this chapter, and we will find out what learning theory has to say about Mei as she faces the new learning situations described above. You will see that learning is complex and multidimensional.

What Is Learning?

LEARNING OBJECTIVE 1

Define learning and distinguish between associative and non-associative learning.

Learning is defined as a lasting change caused by experience. Learning has to be inferred from behaviour—it cannot be directly observed (DeHouwer & Hughes, 2020). For example, you may have recently memorized a complex speech, but until you give the speech there is

no outward sign of this new learning. Therefore, in order to study learning, scientists measure change in behavioural responses.

> **learning** a lasting change caused by experience.

It may seem strange to separate a discussion about learning from a closely-related subject, memory, which is covered in the next chapter. Although learning and memory are indeed interrelated and many of the biological mechanisms (and brain regions) that underlie learning are also critical for memory, the study of these topics has diverged in the laboratory. Traditionally, animals (dogs, monkeys, rats, and mice) were the focus of studies on learning, whereas humans were the predominant focus of studies on memory (see photo). With the advent of neuroimaging technology and a greater public concern for understanding about learning and learning disabilities, more research on learning is focused on humans as well (Płoński et al., 2017). Throughout this chapter, we will discuss how information that scientists have gained from animal experimentation can be applied to questions of human learning.

In general, learning can be divided into two major categories: *associative* and *non-associative* learning (Rudy, 2013). **Associative learning** is a change that occurs as the result of experiences that lead us to link two or more stimuli together. An example of associative learning would be cringing at the whining sound of a dental drill because you associate the sound with the pain the drill has caused you in the past. **Non-associative learning** does not require the linking or association of stimuli.

> **associative learning** learning that involves forming associations between stimuli.
>
> **non-associative learning** learning that does not involve forming associations between stimuli.

For example, the first time you sleep in a new apartment you may find yourself awakened a number of times by the unfamiliar sounds in the apartment (the furnace coming on) or sounds in the neighbourhood (buses, trains, or trucks going by). However, after a few nights you find you are able to ignore these now familiar sounds and are able to sleep without interruption. You have learned not to associate those sounds with anything of meaning.

Tetra Images/Corbis

Studying learning **Learning occurs in both humans and animals in similar ways. Therefore, animal research has contributed enormously to our understanding of the principles of learning in both humans and animals.**

Non-Associative Learning

Non-associative learning is the simpler of the two types of learning. Non-associative learning refers to learning following repeated exposure to a single stimulus or event. This exposure causes a relatively permanent change in the strength of response. That is, non-associative learning does not require learning about an association between multiple stimuli. For this reason, non-associative learning is considered to be the simplest, most basic, form of learning. There are two major types of non-associative learning, *habituation* and *sensitization* (Rudy, 2013).

Habituation

As you learned in Chapter 5, we experience *sensory adaptation* when our senses begin to respond less strongly to repeated presentations of the same sensory cue (Webster, 2012). A smell, such as baking cookies, might be a very welcome and noticeable aroma as you first walk into your house, but after a while you may barely notice the enticing odour. Even though the baking cookies continue to smell as wonderful after you have been home for a while as they did when you first walked in the door, you are no longer aware of the delicious smell—you have become adapted. Your olfactory sense responds less and less strongly, though the same stimulus continues to stimulate the sensory receptors in your olfactory system.

Habituation is different than fatigue of neurons in the sensory receptors (i.e., sensory adaptation). It is easy to confuse habituation with sensory adaptation but the two are not the same. When we use the term **habituation** we are talking about a form of learning

where organisms decrease response to a stimulus after repeated stimulus presentation (DeHouwer & Hughes, 2020). Behaviour is especially important in habituation; in habituation the animal or person has learned to ignore something that is unimportant (Duncan et al., 2014). That is, if something does not pose a threat or is in no other way essential to our survival, the animal or person gets used to it, freeing cognitive resources for more important activities. For example, a bird guarding a nest near your front door will initially fly at you each time you walk down the sidewalk to your front entrance. However, over time this guarding behaviour will decrease and may eventually stop entirely as the bird habituates to your presence. The bird continues to detect your presence but has come to learn that you pose no danger to the nest. However, let's say that following the bird's habituation to your non-threatening presence, a friend brings his children to visit you and while outside playing one of the children pokes at the nest with a stick. Under this renewed threat the bird will dishabituate and will once more fly out to guard the nest.
Dishabituation involves a full-strength recovery of the habituated response in the presence of a novel (new) stimulus. Thus, the habituation/dishabituation response has clear adaptive value because it allows organisms to ignore stimuli that do not convey information of biological significance but to respond to stimuli that are important. (See Psychology Around Us 7.1.) Mei, therefore, is needlessly concerned that she no longer reacts to her grandfather's nighttime wandering. She has simply habituated to sounds that were at first unfamiliar, indicating that she will, in fact, be even more alert to anything unusual in her new home, as she now knows what is usual for this place.

> **habituation** a form of non-associative learning whereby repeated presentation of a stimulus leads to a reduction in response.
>
> **dishabituation** a form of non-associative learning whereby there is a recovery of attention to a novel stimulus following habituation.

As you probably recall from Chapter 4, given preverbal children's limited response options, habituation is used as a tool for familiarizing infants and toddlers with stimuli and then testing for recognition and discrimination. Infants and toddlers direct their gaze to stimuli they are interested in. Therefore, once a baby stops looking at an object of interest, we know that the baby has habituated to it (see photos). Then if researchers show the baby a new stimulus and the baby shows renewed interest in the stimulus (i.e., the baby *dishabituates*), we know that these two stimuli look different to the baby (Gerhard, Culham, & Schwarzer, 2016). Using this technique across the different sensory systems, researchers are able to test visual acuity (for example, whether babies can discriminate between facial expressions), auditory acuity (for example, whether babies can discriminate speech sounds), and so on. Learning theorists also study habituation by examining changes in patterns of neuronal activation in various regions of cortex (Wellman, Kushnir, Xu, & Brink, 2016). For example, Wellman and colleagues (2016) used the habituation paradigm to demonstrate that infants use statistics in learning to draw conclusions about preferences versus probabilities (e.g., showing renewed interest when a person chooses more blue balls than red balls out of a bin of mostly red balls).

Source: StockLite/Shutterstock.com

Habituation in action **When this infant was first presented with the stimulus (the mobile), she was interested in it and stared at it and reached for it. However, over time she habituates to the mobile and stops looking at it.**

7.1 Psychology Around Us

Habituation and Neuropsychiatric Disorders

Habituation is a non-associative form of learning that results in a response decrement to repeated stimulation. Poon and Young (2006) use the metaphor of a firewall to describe the importance of habituation. They argue that habituation serves as an intelligent firewall to the cognitive system as it prioritizes sensory information as actionable versus non-actionable. In typically developing individuals, this simple categorization process produces the ability to ignore that which is known or predictable so that individuals are able to free cognitive resources for processing new information. Therefore, habituation serves as a foundation for more complex cognitive processes. However, in spite of its significance to cognitive functioning, very little is known about the physiological processes that underlie habituation (Ramaswami, 2014).

Of interest, abnormalities in habituation have been identified in a number of diverse neuropsychiatric disorders, including autism spectrum disorders (ASD), schizophrenia, Parkinson's disease, attention deficit hyperactivity disorder (ADHD), Tourette's syndrome, and migraine, and is predictive of symptom severity. In most disorders, reduced habituation (hyperarousal) is reported, but in other disorders enhanced habituation (under arousal) is observed instead. The causes for these habituation deficits are largely unknown. Troy McDiarmid and his colleagues from the University of British Columbia, Lexis Kepler, Aram Bernardos and Catharine Rankin, published a comprehensive review of the role of habituation across a diverse range of

neuropsychiatric disorders, including those listed above (Kepler, McDiarmid, & Rankin, 2020; McDiarmid, Bernardos, & Rankinn, 2017). We will briefly address their findings for ASD.

ASD is characterized by repeated and stereotyped behaviours, inflexible and fixated interests, as well as social and communication deficits. Hypersensitivity (and less commonly hyposensitivity) to stimuli across sensory modalities is common (Sinclair et al., 2017). In support of this, McDiarmid and colleagues (Kepler, McDiarmid, & Rankin, 2020; McDiarmid, Bernardos, & Rankinn, 2017) report that a broad range of studies indicate that habituation deficits in ASD appear early and continue well into adulthood. Among the earliest reported deficits are face-processing deficits. Children with ASD, and their siblings, take longer to habituate to images of faces than do age-matched controls. Habituation study results with older children and adolescents diagnosed with ASD produce mixed results but support the hypothesis that deficits in habituation develop early and persist well into adulthood. The conflicting results (e.g., hyperarousal versus under arousal) regarding the older participants is attributed to diversity in the ASD population and to differences in stimuli across paradigms, but almost all studies report habituation deficits.

Taken together, the overall literature points to a potential underlying cause of the well-known sensory integration dysfunctions common to ASD (Kepler, McDiarmid, & Rankin, 2020; McDiarmid, Bernardos, & Rankinn, 2017). Individuals diagnosed with ASD live lives marked by an overvigilant response to a virtual onslaught of sensory information in their daily lives because they are unable to filter out irrelevant sensory stimuli.

goodmoments/Getty Images

Assault to the senses Children diagnosed with ASD often experience hypersensitivty to senosry information, such as sound.

Sensitization

Sensitization is another form of non-associative learning that involves an altered response

following the presentation of a single sensory cue. Unlike habituation, sensitization involves an increase, as opposed to a decrease, in response with learning (Peeke, 2012). Imagine you are home alone at night reading quietly. Without any warning, your cat knocks over a lamp, startling you (see Psychology Around Us 7.1). You may jump or even shout out in fear before realizing what has happened. And, for some time after you calm down, you are likely to startle again in response to normal auditory stimuli, such as the ring tone from your cellphone. Your enhanced response to this typical stimulus may reflect the fact that sensitization has occurred. As in the case of habituation, sensitization makes good adaptive sense. An unexpected stimulus may signal danger, so an immediate magnified response to stimuli that follow may be helpful for survival.

sensitization a form of non-associative learning whereby a strong stimulus results in an exaggerated response to the subsequent presentation of weaker stimuli.

Source: Jonathan Hayward/The Canadian Press

Associative learning **Dogs associate their barking as the cause of the retreat of the mail carrier, indicating that not all associations are necessarily accurate reflections of reality. That is, the mail carrier would have moved on whether the dog was barking or not; however, the dog associates the mail carrier leaving with**

its own behaviour (barking).

Associative Learning

Non-associative learning does not account for the majority of learning; the majority of learning is considered to be associative. Associative learning occurs when we link two events that occur close together in time, such as when we stop at a red light or when a dog becomes excited at the sight of its leash. Such learning involves making connections—or *associations*—between two or more stimuli (DeHouwer & Hughes, 2020). Most of the learning you engage in as a student is highly associative. Course material involves connecting numerous concepts and facts to produce an overall picture of a certain subject. Learning people's names or learning how to please or influence a parent involves forming associations. Animals also engage in associative learning. For example, when a dog barks at the mail carrier and the mail carrier leaves, the dog learns (in this case erroneously) that its actions have particular consequences (see photo).

Two major types of associative learning are classical conditioning and operant, or instrumental, conditioning. In classical conditioning, as we will see next, we come to associate two stimuli, eventually responding the same way to both. In operant conditioning, which we will examine after classical conditioning, we come to associate stimuli with the consequences that follow. It is important to note that many situations involve both classical and operant conditioning. We will discuss each type of conditioning separately, and then examine how they co-occur in some situations.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

1. What is learning?

2. What happens during habituation? What happens during sensitization?

What Do You Think? • Give an example from your own life of a time when you experienced non-associative learning.

Classical Conditioning

LEARNING OBJECTIVE 2

Describe the basic processes of classical conditioning and explain how classical conditioning is relevant to learning.

Does your cat dash into the kitchen when you open a can of tomato sauce? Do you cringe when you see lightning? Do you think of someone special when you hear a particular song? Do you run out of the room when you see a mouse? It is very likely that you have

experienced one of these scenarios or something very like them. This is because we all experience a type of learning known as **conditioning** (Schachtman & Reilly, 2011). Conditioning involves the association of events in the environment. Therefore, your cat has associated the sound of the can opener with getting fed; you have come to associate the crash of thunder with the sight of lightning; a particular piece of music has become associated with a romantic interlude; and you associate mice with a fear response.

> **conditioning** the association of events in the environment.

This particular type of learning, called **classical conditioning**, describes how these associations are formed (Henton & Iversen, 2012). In classical conditioning a response normally evoked by a neutral stimulus also comes to be elicited by a different stimulus. For example, when you first experienced an electrical storm, you initially cringed only to the loud booming of the thunder. However, after experiencing the multiple pairings of thunder with lightning, you now also cringe at the sight of lightning because you have come to associate the *sight* of lightning with the *sound* of thunder.

> **classical conditioning** a form of associative learning between two previously unrelated stimuli that results in a learned response.

Classical conditioning was serendipitously discovered around the turn of the nineteenth century by a Russian physiologist named Ivan Petrovich Pavlov. His discovery of conditioned reflexes made it possible to study psychic activity objectively and led the way to a systematic investigation of associative learning in the laboratory. Pavlov's original research methods are still used in psychology laboratories today (for examples see Gawronski, Gast, & De Houwer, 2015; Sticht et al., 2015; Guy & Fletcher, 2014). We refer to this form of learning as "classical conditioning" because it was the first systematic study of the basic laws of learning (or conditioning).

Pavlov did not start out to study the mechanisms involved in learning. At 33 years of age, he had earned a medical degree and from there spent roughly the next two decades studying the digestive system; he was particularly interested in understanding the role of the salivary reflex on the action of the stomach during digestion. This work on the digestive system won him a Nobel Prize in 1904 (Gottlieb & Begej, 2014).

What does this have to do with learning, you ask? Before we can answer that question we need to have a basic idea of what Pavlov's experiment was about. First though, we need to identify the term **natural reflex**. Natural reflexes are generally present at birth and do not have to be learned, and as such are considered "hard-wired" into a species. For example, your pupil contracts—shrinks—in response to bright light; you did not have to be taught this response. Pavlov was interested in another such reflex, the salivary reflex. Many animals (including humans) experience reflexive salivation—mouthwatering—at the sight or sound or thought of food. Pavlov conducted his research on the salivary reflex with dogs, giving hungry dogs food under controlled conditions and measuring salivary output. His laboratory apparatus and method are shown in **Figure 7.1**. As time progressed, Pavlov noticed that his dogs were salivating even when food wasn't present. Instead, they began to salivate when the lab assistants first arrived or when they heard noises such as footsteps

that signalled the arrival of the assistants. Although Pavlov initially viewed this premature salivation as a nuisance, he quickly came to realize that these "psychic secretions" were evidence that the dogs had learned to associate the appearance of a lab assistant with getting food. Thus, the dogs were experiencing a behavioural response (salivation) in *anticipation* of getting food (that is, the dogs learned that the assistant was a cue that the food was about to be served). Pavlov realized that the dogs' responses indicated that they were experiencing not only a physiological response, but also a psychological response—a type of learning that originated in the cerebral cortex (Babkin, 1949). He therefore began to study this type of learning in greater detail, eventually systematizing this basic form of associative learning into what is now called *Pavlovian* or *classical conditioning* (Gottlieb & Begej, 2014).

natural reflex an automatic involuntary response that typically occurs without learning.

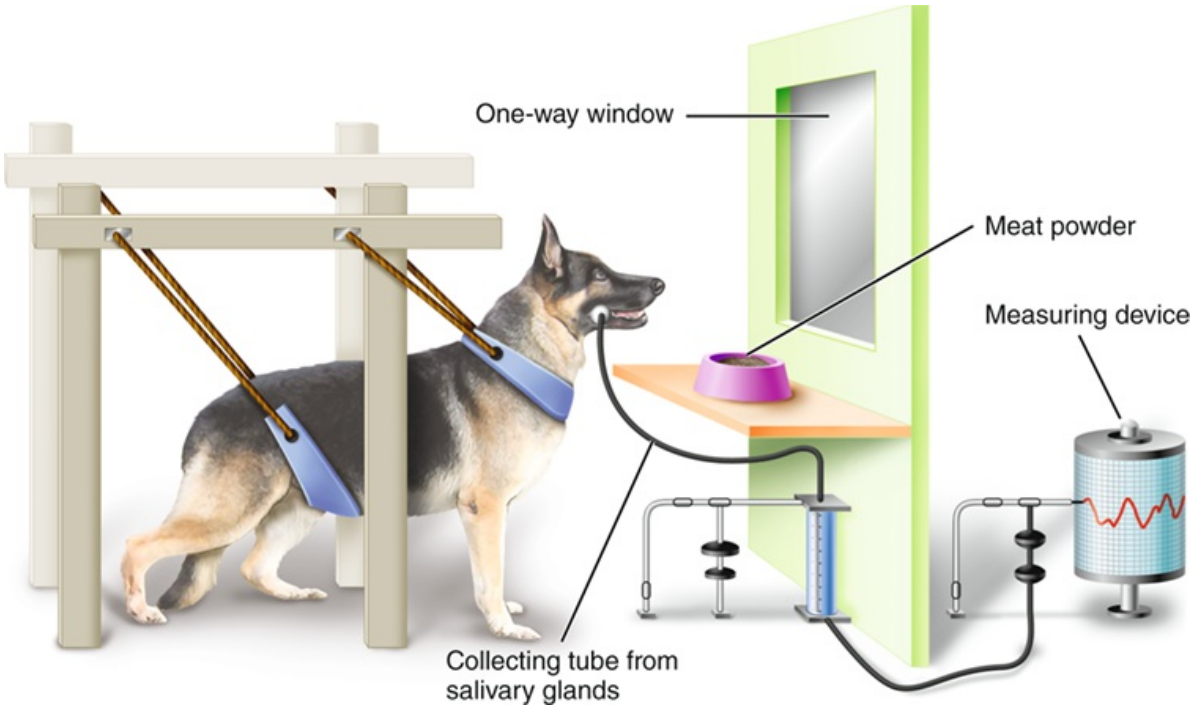


FIGURE 7.1 Pavlov's experiment for collecting and measuring salivation in dogs
The hungry dog is placed in a harness and given a bowl of meat powder. A tube from the salivary gland collects the saliva, which is measured and recorded.

How Does Classical Conditioning Work?

Pavlov's classical conditioning model has only four basic components. But before we begin to describe the process of classical conditioning, note that students are often intimidated at first by the unfriendly and technical jargon that Pavlov used to describe the process of classical conditioning. However, the process of classical conditioning is actually very straightforward and so we suggest that you try to guard against getting overwhelmed by the terminology and just think about the steps first—then learn the terms. Let's start.

To classically condition an organism, a few steps need to be followed. First, a stimulus has to be present that can automatically trigger a response that does not have to be learned. The stimulus that causes this reflexive response is called the **unconditioned stimulus (US)**. Because the response doesn't have to be learned, it is called the **unconditioned response (UR)**. To begin conditioning, the neutral stimulus is presented together with the unconditioned stimulus. After repeated pairings of the neutral stimulus with the unconditioned stimulus (US), the neutral stimulus alone eventually elicits the unconditioned response. After that happens, the neutral stimulus is no longer considered neutral. It is now called the **conditioned stimulus (CS)**, and the physiological response it elicits is called the **conditioned response (CR)**.

> **unconditioned stimulus (US)** a stimulus that on its own elicits a response.
>
> **unconditioned response (UR)** a physical response elicited by an unconditioned stimulus; it does not need to be learned.
>
> **conditioned stimulus (CS)** a neutral stimulus that eventually elicits the same response as an unconditioned stimulus with which it has been paired.
>
> **conditioned response (CR)** a physical response elicited by a conditioned stimulus; it is acquired through experience and is usually the same as the unconditioned response.

Let's now apply these newly introduced terms to Pavlov's original experiment (see illustration). For Pavlov's dogs, the unconditioned stimulus was meat powder. The dogs' unconditioned response was to salivate. So, for the dogs, without any learning, the unconditioned stimulus (meat powder: US) elicited an unconditioned response (salivation: UR). The arrival of a lab assistant was, originally, a neutral stimulus to the dogs. The response is called "neutral" because it initially caused no salivation response from the dog. However, after repeated pairings of the lab assistant with the meat powder, over time, the assistant's arrival alone became a conditioned stimulus. Thus the unconditioned stimulus (the meat powder: US) became paired with the conditioned stimulus (the arrival of the lab assistant: CS). The dog then learned the association between the arrival of the lab assistant and the presentation of the meat powder. Eventually the dog responded to the conditioned stimulus (the arrival of the lab assistant) by salivating. Thus, the conditioned stimulus elicited the conditioned response (salivation: CR). Since this new response is learned (or conditioned), it is now called the conditioned response (CR) and the formerly neutral stimulus has become the conditioned stimulus (CS). The dogs' salivation, once an unconditioned response to the food, is now a conditioned response to the assistant. This process is summarized in **Figure 7.2**.

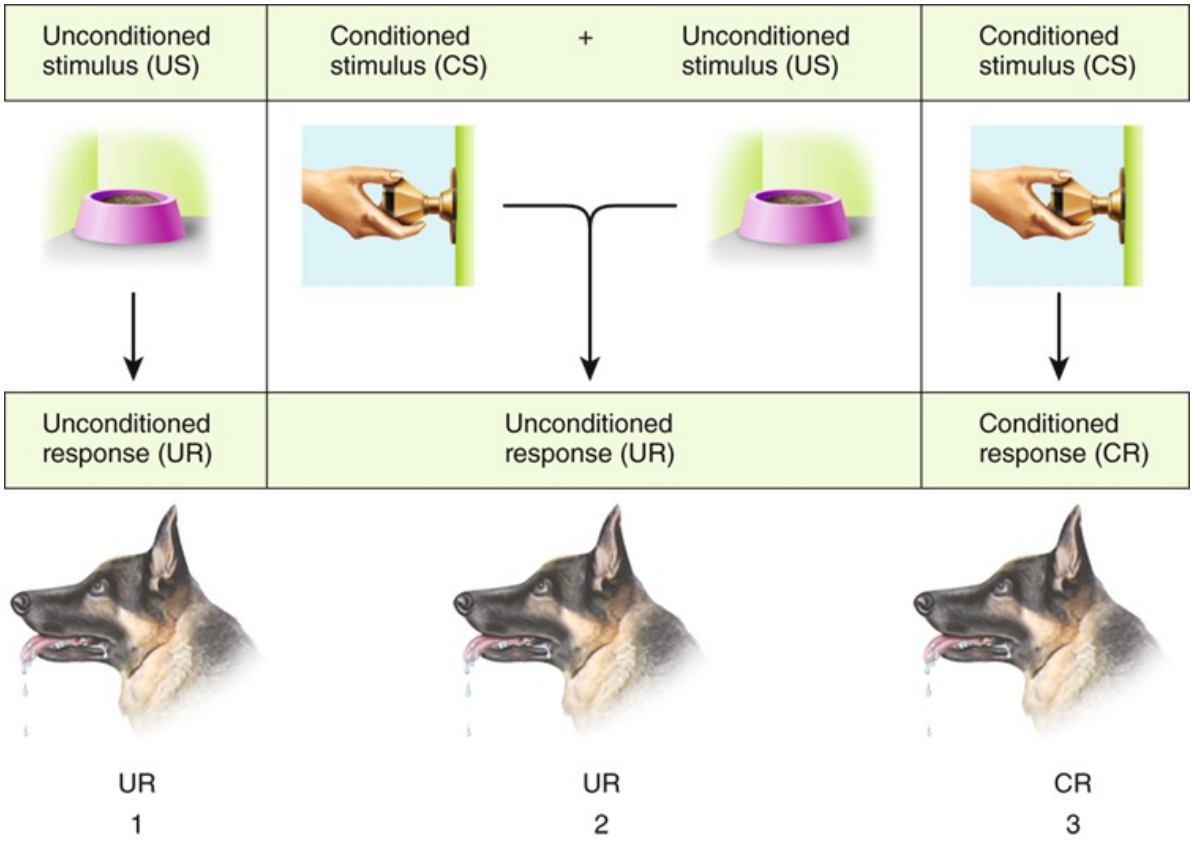


FIGURE 7.2 Classical conditioning The sequence of classical conditioning is shown here, from left to right. (1) The US (meat powder) produces the UR (salivation). (2) During conditioning, the US is paired with a CS, a neutral or conditioned stimulus (a sound such as a doorknob being turned by the research assistant). (3) After conditioning, the CS alone produces the conditioned (learned) response (CR) of salivation.

Classical conditioning is not just for dogs. People can also be classically conditioned. For example, suppose that you come home from school in an unusually bad mood, but as you enter your apartment you hear your roommate playing a particular song and you feel unaccountably happy. On reflection you realize that you have come to associate this particular song with your roommate being in a really good mood and his good mood always makes you happy. Let's break this down using the classical conditioning terms we just reviewed. When your roommate is in a really good mood (US), you are happy (UR). You don't dislike this song, but you have no real attachment to it. However, your roommate repeatedly plays this song (CS) when he is in a really good mood (US). Eventually the song alone causes you to feel happy (CR). You have been classically conditioned. Even babies and young children can be classically conditioned. One of our sons, responding to the romantic music in a movie, turned to his grandmother and said, "Uh oh Gwammie, der's gonna be kissin."

Source: The Granger Collection

A classic moment in history In this famous image, Ivan Pavlov (centre, with beard) stands with his assistants and students prior to demonstrating his classical conditioning experiment on a dog.

There are many, many examples of classical conditioning in our day-to-day lives. Do you feel anxious when you see a police car, even when you know that you are doing nothing wrong? Do you feel even more anxious when you see a police car with its lights flashing? When you are sick, do you feel better after just one sip of ginger ale (a drink your mom always gave you when you were sick as a child)? Do you think of an old boyfriend or girlfriend whenever you smell a particular type of cologne or perfume? Do you feel relaxed the minute you step into your apartment? In the morning do you feel more awake after only one sip of coffee or tea? Have you heard of combat veterans who are frightened when they smell diesel fuel, or of a sexually-abused child who is fearful whenever she sees a male with a beard? These are all examples of classical conditioning. It turns out that Mei can't stop thinking about her aunt because the new house is surrounded by rose bushes, now in bloom. Without Mei being consciously aware of it, the smell of the roses reminded her of her aunt's perfume, causing her to think of her aunt.

Processes of Classical Conditioning

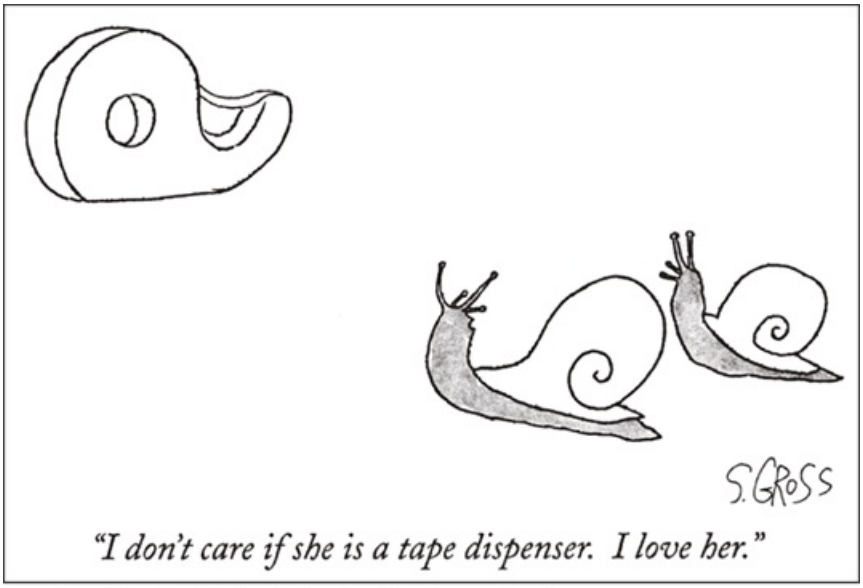
Pavlov identified a number of important processes related to classical conditioning. The first of these processes is related to the acquisition of the association between the conditioned stimulus and the unconditioned stimulus. Not surprisingly, learning is more robust when the number of CS–US pairings is high. That is, the more times that the CS and US are paired, the more likely it is that the association will be learned. For example, if every time you open a drawer it makes an unpleasant squealing sound, you will tense up prior to opening the drawer after only a few attempts. If the drawer catches only once in a while, it will take you longer to acquire an uneasy response in anticipation of the sound.

However, the pairing of the CS–US is not the only important factor in acquisition. Timing also plays an important role in the formation of learned associations. The most effective presentation schedule would be to pair the US and the CS together, with the CS occurring slightly before the US, so that the CS has predictive value (Gormezano, Prokasy, & Thompson, 2014). How much is slightly before? For most species, the optimal delay—that

is, the delay that produces the most rapid acquisition followed by the strongest response—is a half a second delay. Why? Let's imagine that you have a fish bowl in your dining room. Each morning you feed your fish by sprinkling the fish food (US) onto the surface of the water. As soon as the fish detect the food, they swim to the surface (UR). Now let's say that just before you feed the fish you always turn on the light by the fish bowl so that you can see what you are doing. After a number of instances, you realize that the fish are swimming to the surface (CR) as soon as you turn on the light (CS). The fish have acquired a response to the learned association between the conditioned stimulus (the light) and the unconditioned stimulus (the food). Now imagine that you only turn on the light when you enter the dining room to sit down and eat your breakfast. You feed the fish only after you are finished eating. The fish are much less likely to learn the association between the light and the food with this long delay between the two events.

Why aren't people who are afraid of snakes afraid of only one type of snake? Why did Pavlov's dogs respond by salivating to *every* research assistant and not only to the single individual who consistently fed them? The answer to these questions is **stimulus generalization** (Henton & Iversen, 2012). Stimulus generalization occurs when stimuli similar to the original conditioned stimulus trigger the same conditioned response (Haddad, Pritchett, Lissek, & Lau, 2012). So the person or animal responds to stimuli that are similar but not identical to the conditioned stimulus (see illustration). Therefore any reptile resembling a snake elicits a fear response and any assistant in a lab coat elicits a salivatory response. The more ways in which the generalized stimuli resemble the conditioned stimulus, the stronger the conditioned response will be. So, for example, an unfamiliar child in a lab coat might not create as strong a response in the dog as an unfamiliar adult in a lab coat. Stimulus generalization is important because if we rely on past learning to help us decide how to respond to somewhat familiar stimuli and events, we eliminate the need to have to learn how to respond to every single new stimulus we encounter. This frees up mental energy for more important learning.

> **stimulus generalization** what occurs when stimuli similar to the original conditioned stimulus trigger the same conditioned response.



Sam Gross/The New Yorker Collection/The Cartoon Stock

Stimulus generalization **Stimulus generalization occurs when stimuli similar to the original conditioned stimulus trigger the same conditioned response.**

However, at times it is important for organisms to be able to discriminate between stimuli. For instance, some plants are nutritious and others are poisonous; in order to survive, we must know how to distinguish one plant from another. **Stimulus discrimination** occurs when an organism learns to discriminate between the conditioned stimulus and other similar stimuli (Henton & Iversen, 2012). Take, for example, a rat that has been conditioned to expect a shock (US) when it hears a tone (CS). Following the acquisition of this response, the rat can then be taught to discriminate between different tones. If a shock follows only a high tone, the rat can learn to distinguish the tone paired with the unconditioned stimulus (shock) from the other lower tones (no shock). Similarly, at home your cat may be able to discriminate between the sound of a particular kitchen drawer opening—the one containing her treats—and the sound of any other kitchen drawer being opened, and so only responds when the treat drawer is opened.

> **stimulus discrimination** what occurs when an organism learns to emit a specific behaviour in the presence of a conditioned stimulus, but not in the presence of stimuli similar to the conditioned stimulus.

Consider Pavlov's dogs for a moment. As you now know, each dog was conditioned to salivate to the arrival of the lab assistant. Following the acquisition of the learned association between the lab assistant (CS) and the meat powder (US), let's say that bell on the door becomes paired with the arrival of the lab assistant. Even though the bell has never been paired with the meat powder, the dog begins to salivate at the sound of the bell. This occurs because the bell (CS2) has become paired with the arrival of the lab assistant (CS). In this case the original conditioned stimulus (the lab assistant) is functioning as if it were an unconditioned stimulus. This phenomenon is known as **higher order conditioning**. Evidence of higher order conditioning is often observed in advertising

(Geuens, De Pelsmacker, & Faseur, 2011). Advertisers often pair their products (CS) with sexual imagery (US); this type of advertising relies on classical conditioning (see photo). However, when a celebrity is paired with a product, advertisers are relying on higher order conditioning. The celebrity (CS) has become associated with sexual imagery (US), and the celebrity, in turn, becomes associated with the product (CS2).

higher order conditioning what occurs when a previously conditioned stimulus functions as if it were an unconditioned stimulus for further conditioning.

Stacy Walsh Rosenstock/Alamy Stock Photo

Higher order conditioning in advertising **Evidence of higher order conditioning is often observed in advertising, where advertisers often pair their products with sexual imagery.**

Pavlov also showed that a learned response could be eliminated by presenting the conditioned stimulus repeatedly, without the unconditioned stimulus. For example, the lab assistant could come to the lab many times without offering any food to the dogs, or you could move the cat treats to another room. In time, the dog no longer associates food with the lab assistant and your cat stops running to the kitchen when she hears the former "treat" drawer being opened. This phenomenon, called **extinction**, does not represent "unlearning" or forgetting, but is instead a process by which the previously learned CR is actively inhibited (Raio et al., 2016). That is, we don't forget responses that have been conditioned; we simply see a reduction in the strength of the conditioned response (CR). Therefore, a child who associates a parent with pain/fear does not forget the association even though she may no longer cower when the parent is present. For the conditioned response to be permanently removed it would have to be completely extinguished (Dunsmoor, Niv, Daw, & Phelps, 2014).

extinction reduction of a conditioned response after repeated presentations of the conditioned stimulus alone.

Evidence that the information about the previous CS–US pairing still exists after extinction training can be observed by allowing time to pass with no training after extinction has occurred. In this case, the CR will often re-emerge at a later date, at up to half the intensity of its original conditioned level, a phenomenon called **spontaneous recovery** (Figure 7.3). For example, if the assistant hasn't brought food for several visits and the dogs' salivation response has been inhibited by extinction, the dogs might still salivate a week after extinction when the assistant arrives, indicating that the response was not "unlearned." For this reason, a parent who has not engaged in abusive behaviour for some time may continue to elicit a fear response from a child. It is therefore obvious that the previously learned information has not been lost or forgotten, because it can be spontaneously recovered without any further pairing of the US–CS.

spontaneous recovery re-emergence of a conditioned response sometime after extinction has occurred.

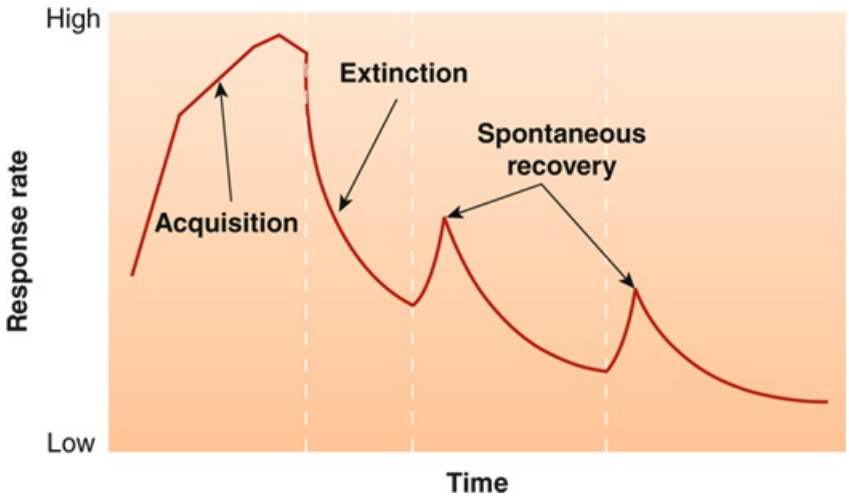


FIGURE 7.3 Acquisition, extinction, and spontaneous recovery **Acquisition occurs as the US and CS are repeatedly paired. When the CS is presented repeatedly without the US, the individual's learned response gradually decreases until extinction occurs. But the information about the previous CS–US pairing is not lost, and the extinguished response spontaneously reappears.**

Classical Conditioning and Drug Dependency

The research of Shepard Siegel at McMaster University has focused on the role of classical conditioning in drug dependency. Drug *use* begins when an individual experiences the effects of a drug as pleasurable. Drug *dependency* involves the psychological and physiological experiences that occur as the individual continues to use the drug; the body adapts to the presence of the drug and the individual experiences withdrawal if the drug is reduced or stopped. Withdrawal is the psychological and physical discomfort and distress experienced when the body is deprived of an addictive substance it has become metabolically adapted to.

Siegel has studied the role that classical conditioning plays in both the physiological and

psychological tolerance that builds up within addicts who regularly inject heroin (Siegel, 2016). *Tolerance* develops in drug users and abusers as they require increasingly larger doses of the drug to obtain the same intensity of effect initially obtained by a smaller dose. Tolerance involves a number of factors, including possible changes at the cellular level in response to the drug (Lin, Arthurs, & Reilly, 2014).

Deaths among addicts due to overdoses of heroin were initially thought to be accounted for by unexpected jumps in the purity or strength of the heroin being injected. However, Siegel (2016) argues that a learned compensatory response (US) can trigger drug tolerance (UR) and may be involved in some drug overdoses (see photo). He argues that the body seeks to compensate for the effects of a drug by initiating a compensatory response (for example, lowering body temperature in anticipation of a rise in temperature caused by heroin injection) when there are environmental cues that the drug is on its way. The greater the compensatory response, the larger the dose required to offset it.

Janine Wiedel Photolibrary/Alamy

Compensatory responses **The environmental context in which heroin addicts inject themselves becomes associated with their body's compensatory response to the heroin. As a result, if they inject themselves in a novel location their body's compensatory response may not be sufficient to counter the effects of the heroin, resulting in an overdose.**

Siegel further argues that the physiologic counter reaction to heroin becomes classically conditioned over time to the process of self-injection and to the location in which the injection is administered (CS). This means that the nervous system, due to classical conditioning, anticipates the arrival of the heroin based simply on external environmental cues (called *extroceptive cues*) provided by the location (e.g., the room, drug paraphernalia, or other characteristic sights and sounds) in which the addict shoots up. When the addict injects in a new environment without the familiar environmental cues, the body's anticipatory response is absent; without these counterbalancing effects, the addict's system may become overwhelmed by the usual dose of heroin, suppressing respiration and killing the individual. The work of Siegel (see Siegel, 2016) also explains why addicts experience cravings when attempting to quit drugs. Exposure to external drug-related cues (CS) causes withdrawal symptoms caused by a compensatory response (CR) in the absence of the drug

(US), causing cravings that can lead to relapse.

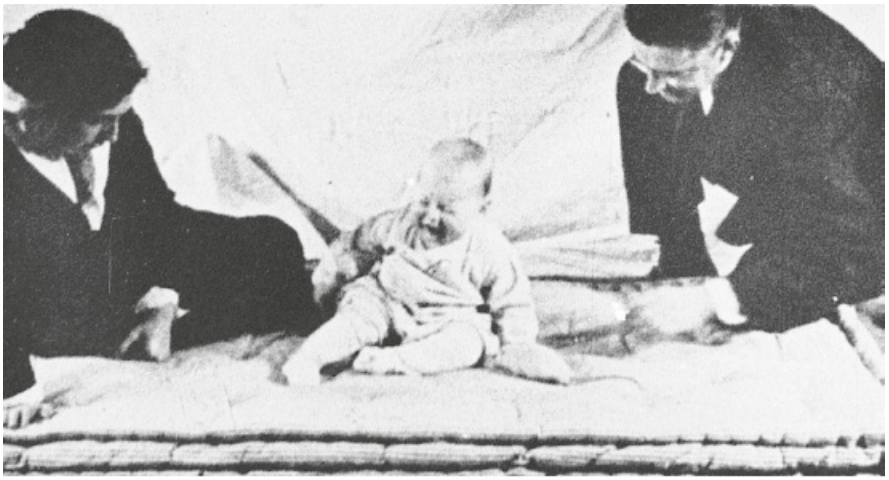
Classical Conditioning and Fears

As the work of Siegel demonstrates, classical conditioning is involved in drug tolerance (2016). Other research has shown that classical conditioning also plays a role in other forms of physiological responding, including immune response (Tekampe et al., 2017; Kusnecov, 2014), allergic reactions (Vits et al., 2013), and fear conditioning (Maren, Phan, & Liberzon, 2013).

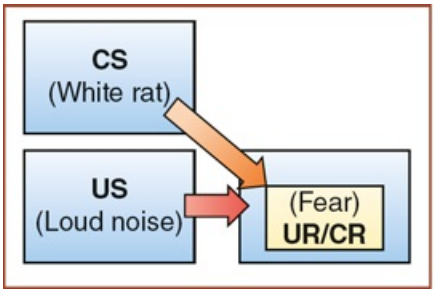
> *Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select—doctor, lawyer, artist, merchant-chief, and, yes, even beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors.*

In this well-known quote, John Broadus Watson, often viewed as the founder of behaviourism, expressed his belief in the all-important role the environment played in shaping individuals. He rejected the role of introspection and the study of the mental worlds of the conscious and unconscious mind as unverifiable and instead argued that behaviourism was the experimental approach that ought to be used in psychology as behaviour was observable and therefore could be studied with complete objectivity. Fear conditioning was first studied by Watson and his student (who, incidentally, later became his wife) Rosalie Rayner (1920). Their most well-known study was the classical conditioning of an 11-month-old baby Watson and Rayner called Albert B, who subsequently became well known as "Little Albert." In the study, Watson exposed baby Albert to an initially neutral stimulus, a white rat. Initially Albert had no fear of the rat, but as he reached forward to touch it, Watson used a hammer to strike a steel bar just behind Albert's head. This loud sound frightened Albert so much that he burst into tears (see photo). Seven pairings of the white rat (CS) with the loud noise (US) made Albert cry and avoid the rat (CR).

Watson also examined the effects of stimulus generalization on creating fear. After conditioning sessions, Watson claimed that Albert, for example, came to fear not only the white rat, but also other furry stimuli, including a rabbit, a dog, a sealskin coat, and Watson in a Santa Claus beard (Karies, 1986). Albert moved away before Watson could attempt to extinguish his conditioned fear and psychologists speculated for some time about what happened to this little boy, wondering whether he grew up with a strange fear of rats, rabbits, coats, and Santa, or whether he was able to overcome his conditioning. Hall Beck and colleagues (Beck, Levinson, & Irons, 2009; Beck, 2011) tracked down Little Albert's identity as well as his fate. Although there is debate about the findings (Griggs, 2015), Beck identified Albert as Douglas Merritte, a boy who suffered from congenital hydrocephalus (abnormal buildup of cerebral spinal fluid in the brain); the researchers discovered that Douglas died at six years of age (Digdon, Powell, & Smithson, 2014).



Courtesy of Benjamin Harris, University of New Hampshire



Teaching a child to fear **In an ethically questionable study, John Watson and his colleague Rosalie Rayner used classical conditioning principles to condition 11-month-old "Little Albert" to fear white rats (shown next to Little Albert's left hand).**

There are serious ethical and moral issues associated with Watson's research with Little Albert (Crawford, 2015). This study would be considered unethical under current Canadian Psychological Association guidelines (American Psychological Association, 2017). Albert's mother was never informed of Albert's participation in the study and the study was carried out without regard for the suffering caused to Albert or for the possibility that there would be lasting harmful effects on Albert's emotional state (Field & Nightingale, 2009). Moreover, Fridlund et al. (2012) report that Watson misrepresented "Little Albert" as "healthy" and "normal" in spite of the fact that Watson knew that was not the case. Further, there are clear suggestions that Watson overstated his results, as several researchers in the past failed to replicate his findings (Samelson, 1980).

Nevertheless, subsequent laboratory studies with animals show that fears are very easily learned (Lonsdorf et al., 2017; Brush, 2014). Fear conditioning of laboratory rodents involves training them to associate a neutral cue (usually a tone) with a painful unconditioned stimulus, usually an electric shock to the feet. Naïve rodents will respond to foot shock by adopting a characteristic posture of immobilization, or "freezing." This response probably reflects adaptive behaviour that small mammals engage in when confronted with a predator and have no way to escape; they minimize movement to escape detection. Typically just a few pairings of a tone with foot shock lead to a lasting CS–US association, causing the rat to freeze to the CS tone alone (Bruchey, Jones, & Monfils, 2010).

Phobias

Some scientists believe fear conditioning is the basis of the development of a category of anxiety disorders called phobias (Marks, 2013). **Phobias** are extreme, irrational, persistent fears of specific objects or situations, many of which pose little real danger (see photos). People who suffer from phobias are believed to have learned an association between neutral (CS) and dangerous (US) stimuli, thus being conditioned to fear a relatively harmless cue (i.e., the CS). For example, take a case where an adult has acquired a fear (CR) of all breeds of dogs (CS) due to being injured/frightened (UR) as a small child when knocked to the ground by an over-exuberant Labrador retriever (US). Due to the generalized association of fear (CR) to all dogs (CS), this person now refuses to go outside if he sees a dog, big or small. Such learned associations are one way that people become conditioned to fear specific objects or situations (we will discuss phobias in more detail in Chapter 15). Any neutral stimulus can become associated with a dangerous stimulus and become the focus for a phobia. Some phobias are common, such as fear of heights, enclosed spaces, spiders, and thunder and lightning; but other phobias are less common, such as fear of forests, marriage, bald men, knees, and clowns. People can truly develop a fear of *anything*.

> **phobia** a persistent, irrational, or obsessive fear of a specific object or situation that may arise as a result of fear conditioning.

In fact, phobias can be very debilitating (for example, Mei's fear of lightning kept her in her room, afraid to venture outdoors), and can have detrimental effects on an individual's ability to live normally. Therefore, therapies are important to help individuals cope with phobias. The theory that phobias arise from fear conditioning has led to the development of therapies that are also based on classical conditioning (Milosevic & McCabe, 2015). In one common process, known as **systematic desensitization**, people who suffer from phobias undergo a series of extinction trials—repeated exposure to the feared object or situation in the absence of pairing with a US (systematic desensitization will be discussed in greater detail in Chapter 16).

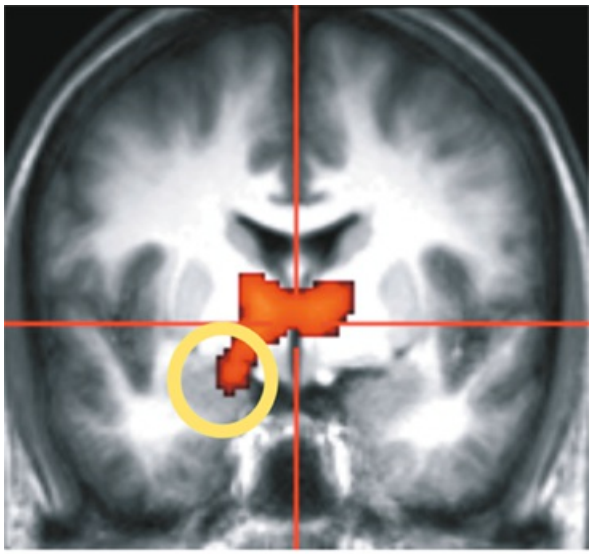
> **systematic desensitization** a process used to condition extinction of phobias through gradual exposure to the feared object or situation.

Neuroimaging studies suggest that phobias involve abnormal activity in the amygdala, a part of the brain that is active when we experience emotions, including fear (Greco & Liberzon, 2016; Campese et al., 2014; Campese, Gonzaga, Moscarello, & LeDoux, 2015). People with phobias show rapid activation of this brain region when exposed to the stimuli they fear most. Extinction training, by contrast, is known to activate part of the prefrontal cortex as phobias diminish (Fitzgerald, Seemann, & Maren, 2014; Herry et al., 2010). Recall from Chapter 3 that our prefrontal cortex can help us inhibit emotional impulses. Thus, phobias that have been desensitized still exist. As a result, they are prone to spontaneous recovery, similar to other classically-conditioned behaviours.

Classical Conditioning and Taste Aversions

Another type of classical conditioning that has been studied in the laboratory has relevance to human learning. **Conditioned taste aversion** involves learning an association between a particular food and a subsequent stomach illness (Chambers, 2015; Garcia, Lasiter, Bermudez-Rattoni, & Deems, 1985). Many of us have had the following experience. You eat a certain type of food and a short time later, you are afflicted with nausea, vomiting, and diarrhea. It is possible that you have food poisoning. However, it can also happen that you eat a certain type of food and then become ill due to something unrelated to the food. For example, you might have had too much alcohol to drink and so now have a hangover, or you may have developed the stomach flu. Either way, whether or not the symptoms are directly related to the food you ate before becoming ill, you will probably develop an aversion to that particular food for some time afterwards. In this case, the US is whatever agent actually made you nauseous, whether bacterial, viral, or chemical. The food you develop an aversion to is the CS. The unconditioned physiological response (UR) is the nausea or other unpleasant gastrointestinal response. Following this initial experience, you will feel ill (experience nausea) simply when exposed to the food. Imagine that you eat salsa and tortilla chips one afternoon while at the beach. Later, you suffer flu-like symptoms due to heat exhaustion. Even though you know you were ill due to heat exhaustion you cannot bear to even look at, or think about, salsa. So, the US (heat stroke) caused you to be ill (UR); however, the salsa (CS) became paired with the heat exhaustion so that now the sight of salsa causes you to feel ill (CR). Conditioned taste aversions happen very quickly. Laboratory research has shown that a single pairing of food and nausea is frequently all that is necessary for a conditioned taste aversion to be formed (O'Donnell, Webb, & Shine, 2010; Garcia et al., 1985; Garcia & Koelling, 1971).

conditioned taste aversion a form of classical conditioning whereby a previously neutral stimulus (often an odour or taste) elicits an aversive reaction after it's paired with illness (nausea).



Reprinted by permission of Elsevier from L. Goossen, et al., Amygdala Hyperfunction in Phobic Fear Normalizes After Exposure, *Biological Psychiatry*, *62*(10), 1119–1125, Figure 1

Phobias and the brain **This coloured brain scan of a cross-section of the brain reveals increased activity in a phobic individual's amygdala (region circled in yellow) while the person is looking at a feared object.**

©iStockphoto.com/espencer1

Arachnophobia **An extreme fear of spiders is one of the most common of all phobias. Around half of all women and 10 percent of all men have at least a mild fear of spiders.**

Not only did you develop this aversion from a single experience, but this aversion to salsa is also particularly impressive given the length of time that intervened between your exposure to the CS (salsa) and your illness. In fact, research shows that the taste of a specific food or drink can be associated with illness up to 12 hours after its ingestion (Lin, Arthurs, & Reilly, 2017; Parker, 2014). Forming an association after such a long delay between the CS and US is quite remarkable; recall that we said earlier that a delay of more than 30 seconds between a CS and a US often makes it difficult to establish a relationship between two stimuli. Separation of a tone from a shock by several hours would make it very difficult, if not impossible, to produce fear conditioning, and yet conditioned taste aversions develop even when the US follows the CS after a significant period of time.

Some people are especially vulnerable to conditioned taste aversions. Pregnant women with severe morning sickness may develop intense aversions to foods that are followed by nausea. Similarly, classic research by Gary Challis and Hank Stam at the University of Calgary shows that people undergoing chemotherapy for cancer treatment can develop aversions to foods they ingest right before a chemotherapy session, due to the nausea occurring as a side effect of the drug (Lin, Arthurs, & Reilly, 2017; Boltong & Keast, 2012). As a result of this research, people undergoing chemotherapy are now advised not to eat favourite foods prior to treatment to avoid developing aversions to foods they love (Andrews & Rudd, 2016).

Producing a Taste Aversion

In pioneering work, researcher John Garcia and his colleagues used classical conditioning

to condition taste aversions in laboratory animals by giving them specific foods to eat or drink and then inducing nausea through injection or radiation, causing radiation sickness (Garcia & Koelling, 1971). The rats rapidly learned the association between taste and nausea. Such conditioned taste aversions, often referred to as the Garcia effect, have been used in Alberta to protect livestock from wolves, in Saskatchewan to protect cows and sheep from coyotes, and in Whistler, British Columbia to keep black bears from eating human food (Homstol, 2011) (see photo). How is this accomplished? Meat (lamb or beef carcasses) or human food is treated with a substance that will cause the coyote or the bear to become ill. The animal then associates illness with the food just eaten and avoids the livestock or human food (see Gustavson, Garcia, Hankins & Rusiniak, 1974; Gustavson, Kelly & Sweeney, 1976).

iStockphoto.com/Lynn_Bystrom

Producing a taste aversion **Conditioned taste aversions have been used in British Columbia to keep black bears from eating human food (Homstol, 2011).**

Not only do taste aversions form quickly, but they are also very specific. For example, why do we form an association between the taste of food and illness? Why don't we form an aversion instead to the friends who were with us on the beach or to going to the beach or to the ocean? The answer is that we are biologically prepared to form associations between tastes and illness (LoBue & DeLoache, 2010). Garcia and other scientists suggest that we have a biological readiness to learn certain associations due to their survival value (Garcia & Koelling, 1966). This biological readiness is adaptive and probably rooted in our evolutionary history. The ability to associate potentially tainted food with a subsequent illness leads to increased survival and reproduction. Those who could not learn to avoid that which made them ill were more likely to be poisoned and to die. In this way, abilities with survival value, such as avoiding potentially tainted food and water, are passed down

to future generations and therefore over time, most people in the population form conditioned taste aversions (Likhtik & Paz, 2015).

Biological preparedness also may help explain why taste aversions are particularly easy to learn for animals that use odour and taste for food detection (e.g., mice, rats, wolves). In these same animals, it is difficult to form an association between a visual or auditory cue and nausea. However, in animals such as birds, who select their food using visual cues, conditioned aversions to flavours or odours are difficult to produce. For example, birds can be more readily conditioned to avoid visual cues (such as a certain coloured bead) when those cues have been paired with stomach illness (Clapperton et al., 2014). Birds often search for prey using vision and conversely also ignore potential prey based on visual cues alone. For example, in a classic study predatory birds were found to avoid prey with aposematic colouring (conspicuous colouring that serves as a warning; for example, on a skunk or a butterfly) (see photo). It is therefore more natural for birds to associate a visual cue, rather than a gustatory or olfactory one, with a subsequent stomach illness.

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Conditioned aversions and visual cues **Birds use visual cues to develop conditioned taste aversions, such as aposematic colouring to identify butterflies that produce an illness when eaten (Brower & Fink, 1985).**

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

3. You take your dog in the car when going to the veterinarian. After several visits, your dog cowers and whimpers whenever he sees the car. Identify the US, UR, CS, and CR in this example of conditioned fear.

4. What is conditioned taste aversion? How does it happen?

What Do You Think? • How might the principles of classical conditioning be used to

keep chemotherapy patients from forming taste aversions to foods they enjoy?

Operant Conditioning

LEARNING OBJECTIVE 3

Describe the basic processes of operant conditioning and explain how shaping can be used to teach new behaviours.

Classical conditioning does not account for the vast majority of learning by complex organisms. Classical conditioning is a passive form of learning that does not involve the active participation of the learner (Henton & Iversen, 2012). In fact, most forms of classical conditioning occur without awareness that the association is being formed. The learner has very little control over the stimuli being associated. For example, a light flashes and a shock follows. The animal or person learns to make the association between the two stimuli, but the learning is involuntary and, importantly, precedes the response. That is, the appearance of the light causes an anticipatory fear response.

In everyday life, however, the majority of our learning is active. Most of us are not passive participants in the environment. Instead, we respond to our environment and modify our behaviour according to the consequences that follow our initial response. For example, if you are only a few minutes late for work but your boss docks you an hour's pay, you can alter your behaviour the following day to increase your chances of being on time. Or, if a parent praises a child for treating a younger sibling with kindness, the older child will more likely be kind to the sibling in future encounters. Psychologists use the terms **operant** or **instrumental conditioning** to describe associative learning that is voluntary (rather than reflexive) and that acts on the environment to produce specific outcomes (Blackman, 2017; Henton & Iversen, 2012). The term *operant* refers to the fact that organisms are learning by *operating* on the environment. Organisms associate their behaviour with specific consequences as they attempt to receive rewards and avoid punishment.

operant or **instrumental conditioning** a form of associative learning whereby behaviour is modified depending on its consequences.

For some of the earliest laboratory studies of operant conditioning, psychologist Edward Thorndike created a contraption called a "puzzle box." This was a cage into which Thorndike placed a hungry cat. As shown in **Figure 7.4**, the animal could escape from the box by pressing a pedal that pulled a string. Thorndike measured the amount of time that it took the cat to free itself. Escape from the box led to a food reward. The first escape from the box occurred through the random actions of the experimental animal. In moving about, pawing at the door, floor, and walls, the cat would accidentally step on the pedal and thus receive temporary freedom and a food reward. Each time Thorndike put the cat back in the box, the cat began to more quickly engage in the same behaviour (pressing the pedal) that helped it to escape the box and obtain the food. Eventually, the cat would immediately step on the pedal when placed into the puzzle box. This work led Thorndike to develop a theory

known as the **law of effect** (Mayer, 2011; Thorndike, 1933), which suggests that behaviours are selected by their consequences: behaviours leading to success or to rewards are more likely to occur again, and behaviours producing unsuccessful or unpleasant outcomes are less likely to occur again. Thorndike proposed that the law of effect applied not only to other animals, but also to humans. He called this type of learning *instrumental conditioning* because the response (stepping on the pedal) was essential (instrumental) to receiving the reward (escape and food).

law of effect a law that states that behaviours leading to rewards are more likely to occur again, while behaviours producing unpleasantness are less likely to occur again.

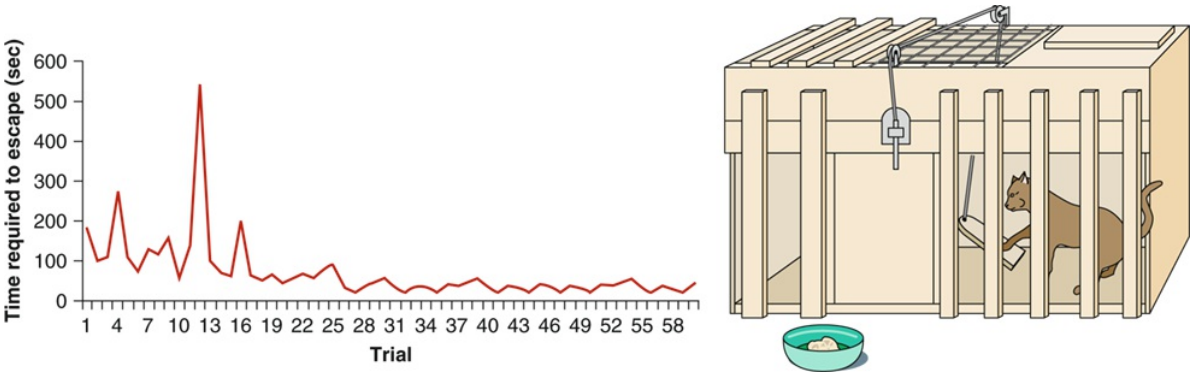
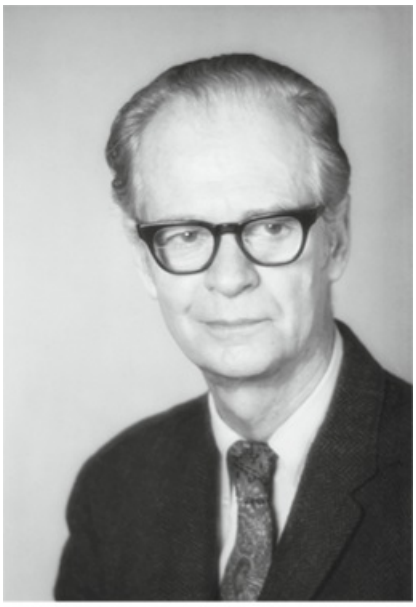


FIGURE 7.4 Thorndike's puzzle box **Edward Thorndike used a puzzle box to study operant conditioning in cats. When the cat accidentally stepped on a pedal that pulled a string, the cat escaped from the box and received a fish reward. Once the cat had done this, it performed the action more quickly when it was put back into the box, until eventually it stepped on the pedal immediately each time it was put in the box.**

How Does Operant Conditioning Work?

Thorndike's ideas about instrumental conditioning became highly influential. For several decades of the twentieth century, the dominant school of thought in psychology was **behaviourism**, the systematic study of observable behaviour (Schultz & Schultz, 2015). Behaviourists believed that, unlike internal events such as thoughts or emotions, behaviour could be objectively studied and measured. Further, they believed that all behaviour could be learned through stimulus–response associations via either classical or operant conditioning. Many researchers, such as leading behaviourist B. F. Skinner (see photo), conducted learning research with laboratory animals such as rats and pigeons to understand the principles of instrumental, or operant, conditioning. Skinner believed that organisms didn't simply respond to the environment; instead they exerted influence (or "operated") on the environment, so he called this form of learning *operant conditioning* (Richelle, 2016).

behaviourism the systematic study and manipulation of observable behaviour.



Bettmann/Getty Images

The founder of operant conditioning Burrhus Frederic (B. F.) Skinner (1904–1990) was a behaviourist who is considered the founder of operant conditioning.

B. F. Skinner's work expanded on Thorndike's law of effect (Proctor & Weeks, 2012). Skinner developed behavioural principles based on the fact that *behaviours that are followed by favourable consequences will likely be repeated*. Using these principles, birds and animals have been taught a variety of behaviours: cockatoos have been taught to play the piano or dunk a basketball, rats have been taught to hoist flags, pigeons to bowl, and whales to wave (**Figure 7.5**). A great deal of human behaviour is also influenced by reinforcement, such as taking medicine for a headache, giving a child an allowance to clean her room, or obeying speed limits. Let's look at some of the key concepts associated with operant conditioning.

Reinforcement

In typical experiments, stimuli are provided in response to the animal's behaviour. These stimuli make it either more or less likely that the animal will engage in the behaviour again (Blackman, 2017). For example, if a laboratory rat presses a lever and receives a food pellet reward, the food works as a **reinforcer**, a consequence that increases the likelihood that the rat will repeat the behaviour or press the lever again. Reinforcers are therefore typically rewarding. However, what is reinforcing for one person may not be rewarding for another; the power of reinforcers varies across individuals and cultures. For example, most people work for a paycheque, but volunteers work for the satisfaction of helping others; a trip to an exotic locale would be reinforcing to some, but anxiety-producing for others; additional income is reinforcing to some people, whereas additional time off is reinforcing to others; and so on. In some cultures money and achievement are valued above most other reinforcers, whereas in others the approval and respect of other members of the group is most reinforcing. Therefore it is important to note that reinforcers and rewards are not necessarily the same thing. (See Psychology Around Us 7.2 for an example of an unexpected reinforcer.)

reinforcer an experience that produces an increase in a certain behaviour.

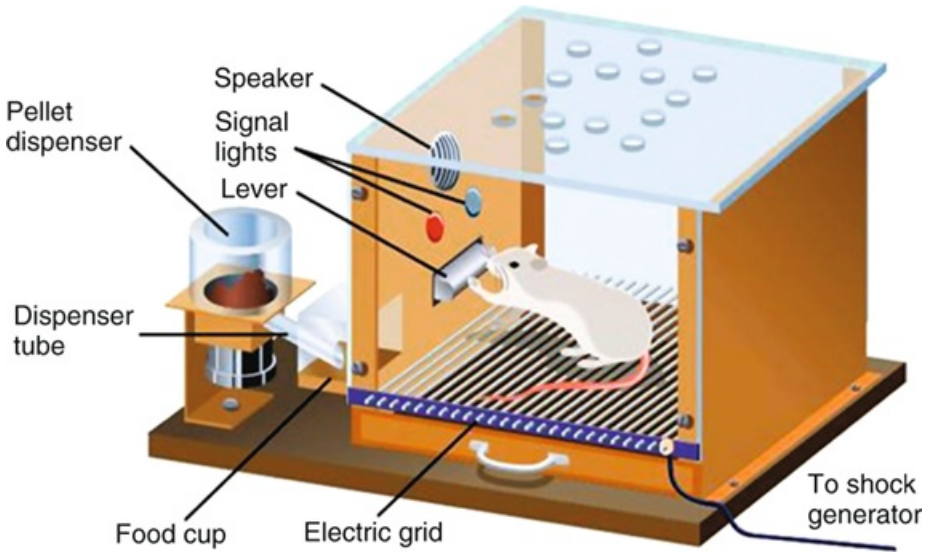


FIGURE 7.5 Skinner box A "Skinner box" is an operant conditioning apparatus devised by B. F. Skinner to test animals. Skinner himself referred to it as a "lever box." The box contained a lever or bar that animals could press in order to receive food or water or other reinforcement. The floor was a grid that was capable of conducting electricity as punishment.

7.2 Psychology Around Us

How Does Learning Theory Explain Why Some People Deliberately Hurt Themselves?

Sometimes a person, usually an adolescent but not always, is either overwhelmed by feelings of intense, painful emotions or instead may feel numb and empty. Most people can cope with these emotional states, but some cannot and may instead engage in self-harm or self-injury to provide relief from unbearable pain. *Self-harm* occurs when an individual inflicts intentional harm on themselves without suicidal intent. Individuals who engage in self-harm may cut their skin with a piece of glass, or a razor blade or a knife (this is often referred to as *cutting* and is the most common form of self-harm), or they may burn themselves, pull out chunks of their hair, pick at their skin, or insert objects under their skin or into their body (Bakken, & Gunter, 2012).

The Canadian Mental Health Association (2014) reported that 13 percent of Canadian youth report harming themselves. This number is probably low as most people who engage in self-harm go to great lengths to keep their behaviour a secret. In fact, due to issues such as shame or under-reporting in interviews, it is estimated that only one in eight episodes of self-harm are seen by professionals or in hospitals (Wright-Hughes et al., 2015). Mary Nixon, at the University of Victoria, and colleagues argue that for this reason standardized self-report measures are a better first-line assessment for this group (Nixon et al., 2015). The *Ottawa Self-Injury Inventory* is one such measure and is

especially useful because it addresses the additive potential for self-harm behaviours (Wright-Hughes et al., 2015).

Melanie Dupuis and colleagues at the University of Guelph (2019) evaluated factors related to thoughts about self-harm in Canadian students in Grades 7 and 10. They examined the relationships between gender, substance use/abuse, and social connection. Their results indicated that females were more likely to report thoughts of self-harm than males, especially if they also reported that they used drugs or had friends who used drugs. As well, both genders were more likely to report thoughts of self-harm if they reported consuming alcohol or smoking cigarettes in the last year; this effect was more significant in younger students. Thoughts of self-harm were reported less frequently in those who reported having friends and believing that people liked them.

Why would a person intentionally harm themselves? Doesn't Thorndike's law of effect argue that only those behaviours followed by a desirable consequence will be repeated? What is desirable about physical pain? For most of us there is nothing reinforcing about physical pain. However, remember what we said earlier: reinforcers *always* increase the frequency of an associated behaviour. Therefore, if a person engages in self-harm and this behaviour is repeated (i.e., strengthened), then something about the self-harm is reinforcing to the person. But what?

In fact, youth who engage in self-harm and who report feeling numb or empty report that the self-harm causes them to feel *something*, anything. By contrast, those youth who report feeling overwhelmed by emotional pain say that the self-harm alleviates their inner pain by turning it into physical pain. E. David Klonsky at the University of British Columbia and his colleagues report that this reduction in unpleasant emotions causes the affected person to feel a sense of "calm" and "relief," and that this sense of relief ultimately rewards the injurious behaviour (Klonsky, Victor, & Saffer, 2014; Victor & Klonsky, 2014). Thus, the escape from intolerable emotion becomes *negatively reinforcing*. But that is not all. When the body is injured it releases endorphins, a naturally-occurring opiate. Endorphin release is often associated with a feeling of euphoria, a state of happiness and well-being. The euphoric feeling following the injury may also *positively reinforce* the self-injurious behaviour.

Learning theory would therefore predict self-harm behaviour through mechanisms of positive and negative reinforcement.

Michael Folmer/Alamy Stock Photo

Self-harm Self-injury is negatively reinforcing for individuals, serving to reduce unpleasant emotions.

There are two kinds of reinforcement: **positive reinforcement** and **negative reinforcement** (Blackman, 2017). In this instance the terms positive and negative do not mean "good" and "bad." Instead the terms are used in a manner similar to the way they are used in medical terminology. The term "positive" here means that something is present or has been added. For example, if you test positive for a strep infection, then the bacteria causing the throat infection is present. On the other hand, a "negative" result would mean that there is no infection; in this case, negative means that something is absent.

positive reinforcement presentation of a pleasant consequence following a behaviour to increase the probability that the behaviour will reoccur.

negative reinforcement removal of an unpleasant stimulus after a response to increase the probability that the behaviour will reoccur.

Therefore, a positive reinforcer presents (or adds) something to increase the likelihood of a response: if your dog sits when you ask her to, you give her a treat; if a child says please, he gets a piece of candy; or if an adult works extra hours, she is given a raise in pay. Referring back to the case of Mei, Yenay offers to help Mei with her coursework if Mei agrees to leave her room and go outside and to interact with her family. In every instance, the animal or person is likely to repeat the behaviour because they have been given something desirable for their initial response. They have all been positively reinforced.

Negative reinforcement is less intuitive than positive reinforcement. To help this concept make sense to you it is important to remember that reinforcement *always* increases the likelihood that a specific behaviour will be repeated (Blackman, 2017). Positive reinforcement increases the probability that a particular behaviour will occur by adding a pleasant stimulus. Negative reinforcement, on the other hand, increases a specific behaviour by *removing* an *unpleasant* stimulus. For instance, when you have a headache,

you take a pain reliever. The pain reliever *takes away* your headache, thereby *increasing* the chances that next time you have a headache you will take a pain reliever. Similarly, say that you normally leave your house for school mid-morning, but in so doing you are consistently stuck in heavy traffic. One day you leave earlier and are pleasantly surprised to see that there is virtually no traffic. You start leaving for school earlier. In this case you *avoid* the heavy traffic (that is, you *take away* the heavy traffic) by increasing your behaviour of leaving home early.

Negative reinforcement is an important consideration in the behaviour of drug addicts. Addicts escape the cravings and other symptoms of withdrawal by taking a drug, thereby increasing the chances that they will take the drug again as soon as they begin to experience the symptoms of withdrawal on another occasion (George, Koob, & Vendruscolo, 2014).

Negative reinforcement also plays an important role in the maintenance of phobias (Muris, 2017; Ricketts & Donohoe, 2017). As already discussed, a phobia is acquired through classical conditioning. However, once the association between the US and CS has been formed, the phobia is maintained as the individual *escapes* anxiety by avoiding the feared object. For example, consider our example of the woman who is afraid of dogs. She is invited to a friend's house for tea, but to get there she has to walk by a house with a barking dog in the yard. The woman will feel anxious at the thought of going outside and encountering the dog. As her anxiety increases, she decides to stay at home and therefore her anxiety drops. She has escaped unpleasant anxiety by avoiding the feared object (the dog), and is therefore likely to resort to avoiding the feared object the next time she is anxious.

Andrey_Popov/Shutterstock

Positive punishment **When a young woman is texting while driving to work and drives her car into the car in front of her, she is unlikely to text while driving again. This positive punishment (crashing her car) weakens the tendency to make the same response (texting while driving).**

Punishment

Punishment *decreases* the likelihood a response will reoccur, weakening the tendency to make the same response. As there is with reinforcement, there are two kinds of punishment: **positive punishment** and **negative punishment** (**Table 7.1**) (Domjan, 2015; Brush, 2014). Students often ask how punishment can be good. The answer is that "it can't." Positive punishment means that something aversive has been *presented* (added) to *weaken* a response. A child is rude to his grandmother and his mother scolds him; a young woman is texting while driving to work and drives her car into the car in front of her (see photo); a man is not watching carefully as he slices a loaf of bread and cuts his hand; or, you decide to try a new restaurant and the food is awful. In every instance, an undesirable consequence was *presented* following each person's actions, thereby reducing the probability that they will repeat the initial behaviour. They have been positively punished.

> **negative punishment** removal of a pleasant stimulus as a consequence of a behaviour to decrease the probability of the behaviour being repeated.
>
> **punishment** an experience that produces a decrease in a particular behaviour.
>
> **positive punishment** presentation of an unpleasant consequence following a specific behaviour to decrease the probability of the behaviour being repeated.

Negative punishment involves *taking away* a pleasant stimulus to *weaken* a response (Domjan, 2015; Brush, 2014). An adolescent is late for his curfew and so his parents say that he cannot use the family car the following weekend; a child spits food at her sister during dinner and is therefore not allowed to have dessert; a preschooler hits another child at daycare and is put into the time out corner (without toys and away from the other children). In each situation, a pleasant stimulus was removed, thereby decreasing the probability that the behaviour would be repeated.

Let's review the differing types of reinforcement and punishment by taking the case of a lever-pressing rat in four different possible experiments. Positive reinforcement would provide a food reward each time the rat pressed the lever; negative reinforcement would turn off an electric shock each time the rat pressed the lever. In both cases, the rat's rate of lever pressing would increase. Positive punishment would provide an electric shock each time the rat pressed the lever, and negative punishment would remove food each time the rat pressed the lever. In these instances, the rate of lever pressing would go down.

TABLE 7.1

Types of Punishment and Reinforcement

	Increase Behaviour	Decrease Behaviour
Add Something	**Positive Reinforcement**	**Positive Punishment**
	Example: Jake is sitting with friends and tells a funny story and his friends laugh. Jake tells more funny stories.	*Example: Meria twists her ankle while wearing her high heels on ice. Meria uses lower heels on ice after*

		her fall.
Remove Something	**Negative Reinforcement**	**Negative Punishment**
	Example: Satinder has a sunburn that is very painful. She rubs on an anaesthetic cream that immediately reduces the painful burn. Next time Satinder has a sun burn she uses the same cream.	*Example: Ansel is rude to his father and is therefore not allowed to go to a concert with his friends the following weekend. Ansel is less rude to his father after being punished.*

Types of Reinforcers and Punishers

Types of Reinforcers

Most reinforcers have survival value for organisms and include food, water, sexual partners, or the ability to terminate pain. These types of reinforcers are called **primary reinforcers** because they satisfy biological needs and are therefore intrinsically pleasurable; that is, they are rewarding by their very nature (Rademacher, Schulte-Rüther, Hanewald, & Lammertz, 2015). However, not all reinforcers satisfy physiological needs. For example, many people work for money or for grades rather than for food or for water. Some reinforcers become associated with primary reinforcers and become *conditioned* (i.e., learned) reinforcers because of this association. We call this type of reinforcer a **secondary reinforcer** (Rademacher et al., 2015). Since secondary reinforcers are learned, they vary from one species to another and from one culture to another. Common secondary reinforcers for human beings include money, grades, praise, approval, acceptance, and so on. Animals will respond to secondary reinforcers such as attention, praise, touch, toys, opportunities to engage in physical play (e.g., a walk), and so on.

> **primary reinforcer** a stimulus that has survival value and is therefore intrinsically rewarding.
>
> **secondary reinforcer** a neutral stimulus that becomes rewarding when associated with a primary reinforcer.

Types of Punishers

Punishers can also be distinguished by whether or not they are naturally aversive or whether they are learned. A **primary punisher** is a stimulus that is naturally aversive to an organism (Lerman, 2019; Murphy & Lupfer, 2014). As such, primary punishers are usually associated with pain or discomfort. Primary punishers include stimuli such as slapping or hitting, shock, uncomfortably loud or high-pitched sounds, exposure to extreme temperature, and so on. **Secondary punishers** are neutral stimuli that take on punishing qualities due to their association with a primary punisher (Lerman, 2019; Murphy & Lupfer, 2014). Like secondary reinforcers, secondary punishers are learned and are consequently also both species and culture bound. For humans, secondary punishers include disapproval, indifference, a verbal "no," criticism, bad grades, demerits, and so on.

For animals, secondary punishers include isolation, verbal rebuke, sounds (e.g., clickers or rattling objects), and so on.

primary punisher a stimulus that is naturally aversive to an organism.

secondary punisher a stimulus that becomes aversive when associated with a primary punisher.

In general, positive reinforcement is more effective than punishment. Punishment tells an organism what not to do by suppressing immediate behaviour, but doesn't show them what they should do instead. Reinforcement is effective at establishing new and more appropriate behaviours. For example, if a child puts himself in immediate danger by running in front of a car, a harsh scolding might be effective at stopping the immediate behaviour. However, positive reinforcement (e.g., praise) for holding a parent's hand or for remaining on the sidewalk instead of chasing a ball will teach the child what to do in future situations, rather than simply what *not* to do in the current situation. Skinner argued that what people really learn about punishment is only how to avoid it. Consequently, if we want to *change* behaviour, we have to use reinforcement.

Positive punishment, especially physical punishment, also has a number of alarming ethical implications (Henton & Iversen, 2012). Joan Grusec at the University of Toronto has reported that children who experience physical aggression are more aggressive to others (Grusec, 2015; Grusec, Chaparro, Johnston, & Sherman, 2013). Similarly, Elizabeth Gershoff (Gershoff, 2017, 2013; Lee, Altschul, & Gershoff, 2015) concluded from meta analyses that physical punishment is associated with a number of long-term problems, including low self-esteem, poor self-concept, and lack of interpersonal skills, as well as delinquency, criminal behaviour, child abuse, and mental health issues. In spite of these findings, researchers in Quebec presented data showing that approximately 40 percent of parents in their study reported slapping or spanking their children (Clément & Chamberland, 2014). And of greater concern, parents who use physical punishment are backed by the Supreme Court of Canada, which, when challenged, upheld a ruling of Section 43 of the Criminal Code of Canada allowing parents and teachers to use "reasonable corrective force" to discipline children under certain conditions; i.e., children between the ages of 2 and 12, without instruments, and on an "instructional" basis (quotes added by authors). A Library of Parliament background paper (Barnett, 2016) provides in-depth review of the pros and cons for repealing Section 43 of the Criminal Code and indicates that approval for keeping Section 43 is still high among the general population. Canada now lags behind most European countries, which have banned physical punishment of children in schools and childcare settings, and 11 countries that have also outlawed parental physical punishment of children (Durrant, 2018; Ending Legalised Violence Against Children by 2030, 2018). (See Practically Speaking 7.1.)

Another problem with physical punishment is that children not only learn to associate fear with the unwanted behaviour, but with the punisher as well. For example, using spanking to punish a child in order to decrease unwanted behaviour is a form of operant conditioning. However, if a parent regularly spanks a child, the child will also form a classically conditioned association between the parent and pain/fear. The two types of learning are therefore related and become two aspects of a single learning experience

(Bouton, 2014), and contribute both to a child learning to fear a punisher and to emulate the punisher's behaviour.

7.1 Practically Speaking

Using Punishment to Teach Children

The United Nations Committee on the Rights of the Child (2006) established that all forms of corporal punishment constitute a breach of children's fundamental rights to protection and dignity. They argue that physical punishment is based on abuse of power by the strong over the weak and that it is degrading to the child and undermines self-esteem. To date, 58 countries, mostly in Europe and Latin America, have abolished corporal punishment. Canada is not one of them. In 2004, Canada's Supreme Court retained the defence of "reasonable" corrective force. Even though the body of scientific evidence indicates that physical punishment is ineffective and harmful and predicts only undesirable outcomes, approximately 25 percent of parents in Canada persist in using it (Durrant, Fallon, Lefebvre, & Allan, 2017).

Joan Durrant at the University of Manitoba and her colleague Ron Ensom reviewed 25 years of physical punishment research (2017). They concluded that parents who model "positive discipline" help children learn to manage stress and take responsibility for mistakes. They argue that "positive discipline" is non-aggressive, self-regulated, and scaffolds learning. Non-puntitive responses to transgressions, such as explaining rules to children, ignoring minor misbehaviour, modelling correct behaviour, allowing the child to experience the natural consequences of their actions, and using quiet time or timeout, are more effective punishment strategies for effective discipline than harsh physical discipline (Gonzalez, Ateah, Durrant, & Feldgaier, 2019; Gershoff, Lee, & Durrant, 2017).

Despite the greater efficacy of reinforcement (Axelrod, 2013), there are situations where mild correction through punishment is sometimes deemed necessary. Research suggests the following guidelines for effective punishment are:

Punishments should be mild.

Positive punishment is most effective when it occurs immediately following the incorrect behaviour.

Negative punishment (such as a timeout) is generally more effective than positive punishment (such as a stern rebuke).

Punishment is most effective when it is consistent. If behaviour warrants punishment once, the behaviour needs to be punished each time it occurs.

Punishment is effective only when the punishment is a consequence of a specific behaviour, rather than, say, a result of the teacher's or caregiver's bad mood or general dislike for the child.

Punishment should be combined with an explanation for the punishment as well as suggestions for alternative behaviours.

Brand X Pictures/Getty Images

Effective punishment **This child will learn best through positive punishment that is mild, immediate, consistent, and based on a specific behaviour. Ideally, she will also learn what she might have done instead.**

Negative punishment is generally considered to be less ethically problematic than positive punishment (Ferguson, 2013), but may still fail to change behaviour in some circumstances (Eder, Krishna, & Van Dessel, 2019). Many parents and preschool teachers use a negative punishment technique called "time out" as a consequence for unwanted behaviour. This method involves removing a child from her surroundings, generally by putting her in a separate location in the classroom or home. The child has thus had a pleasurable stimulus (access to playthings and classmates) removed. Time out also removes the child from the environment that may have contributed to the bad behaviour and allows quiet time to think about the situation. The effectiveness of time out depends on the specific circumstances motivating the individual. For example, if the child was acting out to gain attention, then intervening with a negative punishment may not effectively eliminate the behaviour, as the child is receiving the attention she wanted. Also, removal from a certain environment, such as the classroom or the dinner table, may not be sufficiently unpleasant to alter the offensive behaviour. For example, removing a child who is bored and sitting at

the dinner table to his bedroom might be counterproductive, as being in his room might be more interesting than remaining at the table.

Eric Raptosh Photography/Blend Images/Getty Images

The house always wins **Slot machines are a good example of a variable ratio schedule reinforcement strategy. The big payout will come eventually, but you don't know when!**

Schedules of Reinforcement

In real-life situations, we are not usually reinforced or punished every time we perform a particular behaviour. You may, for example, hold the door open many times a day for the person who walks in behind you, but only receive a pleasant "thank you" once or twice a day. Researchers have studied the effects of different schedules of reinforcement on behaviour (Evans, 2017; Skinner, 1958; Skinner & Morse, 1958). When a behaviour is reinforced every single time it occurs, reinforcement is said to be **continuous**. Continuous reinforcement results in rapid learning, but can be easily extinguished. In contrast, **intermittent** or **partial reinforcement**, when the behaviour is only sometimes reinforced, is more slowly acquired, but is difficult to extinguish (Blackman, 2017). Recall Mei's fear of lightning. Since the storms occur at unpredictable times, Mei cannot anticipate when to stay inside, so she stays in her room all of the time. There are several possible schedules of intermittent or partial reinforcement. The most common types of intermittent reinforcement schedules are described in **Table 7.2**.

continuous reinforcement what occurs when behaviour is reinforced every time it occurs.

intermittent or **partial reinforcement** a schedule of reinforcement where the behaviour is followed by reinforcement only some of the time.

In a *ratio schedule*, reinforcement is based on the *number* of behavioural responses. In a **fixed ratio schedule**, a person or animal is rewarded every time they make a

predetermined number of responses. The "frequent customer" card at your local coffee shop may offer you a free cup of coffee after you pay for a dozen other cups, for example. In a **variable ratio schedule**, reinforcement occurs for a predetermined average number of responses. Slot machines or VLTs (video lottery terminals), if they are legally regulated, have a set variable ratio payout schedule (see photo). Depending on the local laws, VLTs pay back 80 to 95 percent of the money entered into them, but on a randomly assigned schedule.

fixed ratio schedule a schedule of reinforcement that occurs after a specific number of responses.

variable ratio schedule a schedule of reinforcement that occurs when the number of responses required for reinforcement is unpredictable.

In an *interval schedule*, reinforcement is based on elapsed *time*, rather than on the number of behavioural responses. In a **fixed interval schedule**, such as occurs with a weekly salaried paycheque, you are reinforced every time a certain period of time passes, following the last reinforcement period. So after two weeks you receive a paycheque but then you must work another two weeks before receiving the next paycheque. Similar to a variable ratio schedule, a **variable interval schedule** provides random reinforcement, giving a predetermined number of reinforcements over time, based on the passage of an average period of time since the last reinforcement. For example, imagine a teacher who wants to reward a student for remaining on task. Each time the student is on task when the teacher checks, the student gets a Pokemon card. In this example let us imagine that the teacher is reinforcing on average once per hour. However, the presentation of the reinforcement is unpredictable (variable). For example, the reinforcement might come immediately after the morning bell in the 9:00 hour but does not come until half-way through the 10:00 hour and at the end of the 11:00 hour, and so on. On the following day the student might be reinforced at the end of the 9:00 hour, the beginning of the 10:00 hour, and half-way through the 11:00 hour, and so on. In this way, the student is reinforced once per hour but cannot know exactly when the reinforcement will occur within any given hour.

fixed interval schedule a schedule of reinforcement that occurs every time a specific time period has elapsed.

variable interval schedule a schedule of reinforcement that occurs after varying amounts of time.

TABLE 7.2

Intermittent Reinforcement Schedules

Schedules Based on Number of Responses			
	Definition	**Response Rate**	**Example**
Fixed ratio	Reinforcement occurs after a predetermined number of	High, with pauses after	A rat is reinforced for every tenth bar press

	responses	reinforcement	
Variable ratio	Reinforcement occurs after an average number of responses	High, regular rate of response	A slot machine pays out after an average of 20 tries, but the payout intervals are unpredictable
Schedules Based on Intervals			
Fixed interval	Reinforcement occurs after a fixed period of time following a correct response	Low, with increases as time for reinforcement approaches	A worker receives a paycheque every week
Variable interval	Reinforcement occurs over varying and predictable time intervals since the last correct response	Low, as reinforcement is tied to time rather than to output	Work breaks occur at unpredictable intervals, such as 60 minutes, 72 minutes, and 54 minutes

Intermittent or partial reinforcement schedules take longer to train but are more effective than continuous reinforcement at maintaining behaviour. With continuous reinforcement, the behaviour is always paired with the reward. If reinforcement stops, the elimination signals a major change in the association between stimulus and response. By contrast, with intermittent reinforcement, the behaviour is followed by reinforcement only some of the time. When a response occurs but is not reinforced, it's not readily apparent whether or not the reward has stopped altogether. Continuing to engage in the behaviour makes sense in case a reward might happen. Thus, behaviours that are acquired through partial reinforcement are harder to extinguish than behaviours that are acquired through continuous reinforcement.

Using Operant Conditioning to Teach New Behaviours

Until now, we have described how operant conditioning can lead people and animals to increase or decrease behaviours that they already display at least some of the time. Thorndike's cats, for example, learned to press the pedal in the puzzle box more often than they would have by chance, but they already pressed the pedal at least once in a trial and error fashion before learning the association. However, operant conditioning can also be used to teach people and animals entirely new complex behaviours.

A method, called **shaping**, rewards actions that are increasingly closer to a desired final behaviour. Shaping is a more realistic way to train a new behaviour, rather than waiting for the exact behaviour to happen by chance before providing reinforcement. Animal trainers begin by giving food rewards in response to minor movements in the direction of the desired behaviour. As the animal masters that component of the task, trainers make the food reward dependent on the animal completing more of the task. Consider training a dog to roll over. First you might provide a treat if the animal lies down on its stomach. Eventually, you would require the dog to perform something closer to rolling over in order to get the same reward; for example, you might offer a treat only when the dog lies down and turns a bit to the side. You carry on in this way, rewarding *successive approximations* to the desired behaviour until the complete behavioural sequence emerges (see photo). See

Positive Psychology 7.1 to see how highly trained animals help patients with psychiatric disorders.

> **shaping** introducing new behaviour by reinforcing close approximations of the desired behaviour.

Biology plays a role in determining how easy or difficult a particular learning task will be for a certain species. Although some trainers appear to be quite capable of teaching animals to engage in a wide range of unnatural behaviours, it turns out that there are, of course, limits, or *biological constraints*, to what animals of a specific species are able to master. For example, two former students of Skinner, Keller and Marion Breland (1961), reported in a classic research study that through shaping techniques they were able to train raccoons to pick up a single coin and place it in a piggy bank. However, they were never able to train the raccoons to take more than one coin to the bank at a time. As you may know, raccoons have a natural tendency to wash food before eating it. It turns out that if the raccoons were given more than one coin at a time, their natural tendency to wash objects interfered with the shaping techniques, and instead of putting the coins into the bank, they become distracted, incessantly rubbing the coins together, "washing" them, instead of completing the task of putting them in the piggy bank. Breland and Breland (1961) referred to this inability to produce a conditioned response due to a return to instinctive behaviour as *instinctive drift* (Mazur, 2017).

7.1 Psychology Around Us | Positive Psychology

Service Dogs and PTSD

You have no doubt seen a person with a guide dog or an assistance dog at some point in your life. Guide dogs are trained to help people with visual impairments to avoid hazards and to perform daily tasks (Vincent et al., 2015). Service dogs perform similar tasks but for people with other types of disabilities, such as hearing impairments, epilepsy, or physical impairments. Dogs help their human partners to navigate through the environment, alert them to sounds, open doors, fetch objects, carry items, and many other tasks. Because users of assistance dogs trust their well-being to their dogs, the dogs—and their owners—must be trained at accredited schools such as Assistance Dogs International or the International Guide Dog Federation. These programs are required to adhere to strict industry standards and to meet comprehensive requirements and criteria, both in the treatment and welfare of the dogs, but also in how they select, train, and care for the dogs. The human client is also provided with a thorough education in order to understand every aspect of working with a service dog.

Recent research has indicated that, alongside research-supported interventions such as prolonged exposure, cognitive processing therapy, and eye movement desensitization treatment, service dog programs are highly effective as complementary interventions for military veterans with PTSD (Scotland-Coogan, Whitworth, & Wharton, 2020; Whitworth, Scotland-Coogan, & Wharton, 2019). Veterans are enthusiastic about participating in psychiatric service dog programs, and attrition for these programs, unlike other programs, is low. New veterans suffering from PTSD

completed a 14-week service dog program. Upon completion of the program, the veterans demonstrated a significant reduction in PTSD symptoms, a reduction in intra/interpersonal difficulties, and reported feeling less anxious, defensive, and fearful, as compared to age- and symptom-matched controls on a waiting list (Scotland-Coogan et al., 2020; Whitworth et al., 2019).

Geneviève Lessard at the Université de Montréal and colleagues assessed the benefits of animal-assisted therapy for veterans living with PTSD who had been using a psychiatric service dog between two and four years (2018). Beneficial long-term effects were noted. Veterans reported that the dogs contributed to their feelings of safety, detected and intervened when they were emotionally volatile or depressed and apathetic, provided companionship, and helped them to socialize and feel less alone. Specifically, among the tasks completed by the dogs, veterans reported that the dogs detected and woke them from nightmares, aided them when disoriented to return to a safe space or to a designated task, and helped maintain appropriate space around them.

These studies and others indicate that service dogs provide both psychological and physiological effects for veterans with PTSD. Veterans develop a close bond with their supportive service dog providing a "bridge" by which to reach out and reconnect with others, leading to significant improvements in relationships. As well, the relationship with a dog that is solely focused on its owner also leads to increases in oxytocin, leading to improvements in mood (Rodriguez, Bryce, Granger, & O'Haire, 2018).

For further information about guide and assistance dogs in Canada, see the website for the Canadian Association of Guide & Assistance Dog Schools at www.cagads.com/index.html.

Jason Hohnberger/Getty Images

Supportive friend **Service dogs provide veterans with relief from many of the persistent symptoms of PTSD.**

Kaku Kurita/Gamma-Rapho via Getty Images

A natural? No. This water-skiing monkey underwent many learning trials and received rewards for many successive approximations of this behaviour before it became skilled at water-skiing.

Shaping is highly effective in modifying the behaviour of animals and can be used to teach people, too. Humans regularly learn behaviour through shaping as successive approximations to an identified skill are reinforced. Teachers use shaping in school to teach children how to print; coaches use it to teach skills in gymnastics or baseball; and parents use it to teach skills to their children. For example, language production involves shaping. When first learning to talk you may have referred to water as "wawa" then later as "wat a" and then now (we hope!) as "water."

A process called **behaviour modification** is frequently employed to shape the behaviour of people. The behaviour of individuals can be shaped to teach them new academic or athletic skills or to modify behaviours that are undesirable (Kazdin, 2012). For example, imagine a child who is disruptive in a classroom. The child's teacher wants him to sit quietly in his desk. So, the teacher systematically begins to shape the child's behaviour toward the outcome the teacher desires. The teacher has determined that playing video games is rewarding to the child. So the teacher gives the child a sticker whenever he is quiet (even if he is out of his desk). After the child gets a particular number of stickers (say seven), he is allowed to play a video game for 10 minutes. Eventually the child is only rewarded for standing quietly near his desk, then for sitting at his desk talking quietly, and so on. In this way the child's behaviour is shaped toward the desirable outcome. (See Indigenous Experiences 7.1.)

behaviour modification a systematic approach to change behaviour using principles of operant conditioning.

7.1 Indigenous Experiences

Lateral Violence and Fear-Based Learning

Rocky James (2020), from the Coast Salish Nation, and the University of British Columbia, has developed a grounded theory of fear-based learning that he defines as "a violent coping mechanism learned in residential school as a means of coping with stress, conflict, and relationship development" (p. 338). He further suggests that a sub-process of fear-based learning developed in residential schools; he calls it "podding." According to James, podding occurred when a group of people joined to prevent others from accessing resources. One of James's research participants reported: "I saw this podding together of this strange thing that was taught in residential school; and they'd pod together and then attack, or intimidate, or be aggressive, or show this one person they're not a part of this group. So that's how I saw it operate" (James, 2020, p. 338).

James argues that this fear-based learning is a form of lateral violence that developed in residential schools. He argued that because children were cognitively immature and because they had limited experience in dealing with such life-altering circumstances, they often directed their rage at their peers (James, 2020).

Louisa Birote attended the La Tuque residential school in Quebec. She tells how the girls at the school formed several hostile factions. "We hated each other. So, this little gang didn't like the other gang. That's the way at the school, that's what we were taught, fears, and we were scared" (Birote, 2013, p. 166).

Although this helplessness and rage began in the residential school setting, it moved from there to home, to community, and ultimately into First Nations institutions more broadly (James, 2010, 2020; Bombay, Matheson, & Anisman, 2014).

Lateral violence is an internalized form of aggression experienced by those with little power and is directed horizontally (sideways). This form of aggression occurs when the sense of helplessness experienced by those in vulnerable positions causes them to direct their anger toward themselves or others with equal, or even less, power. This anger can take the form of bullying, gossiping, shaming, sabotage, social exclusion, blaming, and a host of other negative behaviours (Bailey, 2020). Victims of lateral violence often direct the aggression they experience in turn toward others in their families and communities (Bombay et al., 2014). Allen Benson, the CEO of Native Counseling Services of Alberta, says, "As oppressed people, we want to say we have that little bit of power over somebody and we've just dragged ourselves down as a society instead of supporting each other in the community. As long as we internalize the pain and don't forgive people, we'll carry it with us forever" (Korff, 2020).

Alanna Dumonceaux / Design Pics

Internalized aggression **Helplessness and rage often cause those who are hurt to hurt others in situations similar to or worse than their own.**

Elders have said that if Indigenous people wish to resolve the lateral violence in their midst, they must publicly acknowledge its presence and develop self-determination (e.g., gain control over schools and education and generate economic bases). As well, they must return to traditional ways of dispute resolution, such as healing circles and sharing circles (Korff, 2020).

Critical Thinking Questions

How are "podding" and "fear-based" learning related?

What do you think James (2020) meant by "lateral violence"?

Why do you think that some residential school victims who experienced lateral violence at school later directed their aggression against their families and communities?

Sometimes our prior learning experiences can cause problems with later learning situations. One problem that can arise as the result of operant conditioning is a phenomenon known as **learned helplessness**, in which prior experiences with inescapable punishment condition people or animals to accept punishing consequences in later situations when they could actually avoid them (Seligman, Weiss, Weinraub, & Schulman, 1980). For instance, research with rats has found that, after repeated inescapable shocks to the tail, if rats are given the option of escaping a foot shock by moving to a different area in the testing cage, many of them fail to do so (Weiss & Glazer, 1975). The rats that could not escape the tail shocks initially failed later to learn how to stop a shock to the foot. Learned helplessness occurs when organisms are exposed to conditions over which they have no control. Since there is no association between their behaviour and the consequences of their behaviour, they learn to stop trying, even when they get into situations where their behaviour could make a difference.

learned helplessness a situation in which repeated exposure to inescapable punishment eventually produces a failure to make escape attempts.

Learned helplessness is viewed by some researchers as emulating "stress and coping" aspects of animal models of depression (Slattery & Cryan, 2017; Maier & Seligman, 2016; Richter et al., 2012; Vollmayr & Gass, 2013). Humans with depression are often unmotivated to act on the stimuli they receive from their environments, and some theorists suggest that these people have learned this pattern of inaction from earlier, perhaps unrelated, experiences in which they were unable to make the changes they wanted (Maier & Seligman, 2016). Some researchers have claimed that learned helplessness may also partially explain some of the characteristics of battered spouse syndrome (Salcioglu, Urhan, Pirinccioglu, & Aydin, 2017; Ali & Naylor, 2013). Repeated, inescapable abuse may cause learned helplessness. The victim can become withdrawn and unable to respond in an adaptive way, even if there is an option to escape an abusive situation. It is important to note, however, that some victims may not feel that they have a viable means of escape, and that learned helplessness cannot therefore account for all cases of battered spouses remaining in dangerous situations (see photo).

JOHNGOMEZPIX/ iStock / Getty Images Plus

Intimate partner violence **One third of police-reported violence in Canada is due to intimate partner violence (IPV), with over 99,000 victims of IPV reported in 2018 (Conroy, Burczycka, & Savage, 2019). Although these numbers seem high, they are vastly underreported, with fewer than 1 in 5 spouses reporting abuse to police (Burczycka & Conroy, 2018).**

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

5. What are positive reinforcement and negative reinforcement? What are the effects of each on behaviour?

6. What are schedules of reinforcement? Which schedule results in the fastest learning? Which schedule should be used if you want a behaviour to be resistant to extinction?

7. What is learned helplessness?

What Do You Think? • How could you use operant conditioning principles to get a roommate or child to regularly hang up her coat instead of throwing it on the floor?

Observational Learning

LEARNING OBJECTIVE 4

Define observational learning and summarize concerns about observational learning from the media.

Studies of animal behaviour in natural habitats have shown that members of certain species learn tasks by watching each other. A good example of this type of learning can be seen by studying a troupe of Japanese macaques. This troupe of monkeys routinely washes sweet potatoes before eating them. This washing behaviour is not innate; that is, it is not practised by macaques all over the world. Instead, it began with one creative monkey who first started washing sweet potatoes after the potatoes were introduced to the macaques by researchers. After observing this behaviour, other members of the group started to wash their own sweet potatoes—similar behaviour has now been observed in the troupe with other foods as well (Nakamichi, 2016; Nakamichi, Kato, Kojima, & Itoigawa, 1998). Other studies have reported that **observational learning**, or **social learning**—learning from watching the behaviour of others—led to the use of novel tools by dolphins and certain primate and bird species (Auersperg et al., 2014; Kopps et al., 2014). Through observational learning, animals can culturally transmit learned behaviours across generations. That is, parents or older members of a group engage in behaviour that the young observe. Observation leads to imitation, or **modelling**, which is considered evidence that learning has occurred (Beran, 2020).

observational learning or **social learning** learning that occurs without overt training in response to watching the behaviour of others, called models.

modelling what occurs when an observer learns from the behaviour of another.

© Photograph by Frans de Waal from *The Ape and the Sushi Master*

Imitating Imo A Japanese macaque washes its sweet potatoes in ocean water. This behaviour is displayed only by members of the monkey's particular troupe. Apparently they learned it by imitating the innovative behaviour of a young monkey named Imo.

In addition to contributing to learning through imitation, observation can affect other types of behaviour that indirectly signal learning has occurred. A good example of this can be seen in a classic reward study observing capuchin monkeys (Brosnan & de Waal, 2003). Capuchins can be rather easily trained to perform a task for a food reward, such as a cucumber slice, which they like. If, however, the trained monkey observes another monkey receiving a more desirable reward (for example, a grape) for performing the same task, the monkey will respond by refusing to carry out the task again unless the reward is a grape (and may even express displeasure by throwing the cucumber at the researcher). This suggests not only that capuchin monkeys have an internal concept of fairness, but also that they have used the experience of observing the consequences of another monkey's behaviour to modify their own (see Brosnan & de Waal, 2012 for review).

There are many other examples of animals and birds learning through observation (see photo). In a documentary, Jacques Cousteau (Cousteau & Diole, 1973), the well-known filmmaker and oceanographer, showed an octopus learning to open a jar through observation. He gave a hungry octopus a sealed jar with a crayfish inside. The octopus tried to break the jar by exerting pressure on it. Next, while the octopus watched, the researchers took the jar and unscrewed the lid. They then gave the octopus a second jar with a crayfish inside. The octopus immediately opened the jar by unscrewing the lid.

Bennett Galef, Jr. and his students and colleagues working at McMaster University have shown that social learning plays an important role in shaping behaviours of many animal species. For example, rats fed bad-tasting food or food that tastes like food that has made them ill in the past will watch other rats make food selections and then make the same selection for themselves, even if it is the food that made them ill (Zentall & Galef, 2013). In another area, female Japanese quail will show a clear mating preference for males they

have observed mating successfully with other female quails, essentially copying the other quails' mate selections (Galef, 2015).

Further, Joshua Klein (2011) has had success training crows to use a vending machine. Klein was inspired by reports of crows in a particular Japanese city devising an ingenious method for cracking nuts. Crows there enjoyed a particular type of nut but could not shell them to eat. Eventually some crows discovered that if they dropped nuts on the road, cars would run over them, opening them for the crows to eat. Unfortunately, this solution produced another problem for the crows; it was very hazardous to stand in the middle of the road to eat the nuts once they were opened. Over time, one crow apparently learned that if he dropped the nuts into city crosswalks, allowing cars to crush the nuts, but then waited for the "walk signal" before retrieving the prize, it was much safer to fly down and eat. Over time, the other crows learned how to crack nuts as well, simply through observation. Now many crows in this Japanese city eat nuts using this method. Based on his knowledge of this situation, Klein designed a vending machine that produced peanuts when coins were dropped into a large slot. He started by laying peanuts and coins around on the machine. Once crows had eaten all the available peanuts, they started sweeping coins around with their beaks looking for more peanuts. When a coin happened to fall into the slot, a peanut appeared. Over time, the crows figured out how the vending machine worked, and started picking up coins lying around on the ground and dropping them into the machine to obtain more peanuts. Again, like the Japanese crows, it was not long before more crows learned how to "buy" peanuts by watching other crows. (To see Klein's crow vending machine go here: www.youtube.com/watch?v=bXQAgzfwuNQbut)

Although controversial, many biologists have argued that observation and modelling behaviours constitute a type of animal culture. Regardless of whether such behaviours are evidence of "culture," it is clear that many species of animals engage in a learning process that is socially transmitted (Whalen, Cownden, & Laland, 2015).

Similar examples of socially transmitted behaviours are evident in human behaviour. Humans also learn through observation, using others as role models and, sometimes, modifying our own behaviour in new ways to accommodate new information. Suppose a classmate is warmly rewarded with praise for asking a question in a lecture. You now have information that the instructor welcomes questions. As a consequence of observing your classmate's rewarding experience, in the future you may be more likely to ask a question of your own. That is, you have learned to imitate your classmate's behaviour.

It is important to note that observational learning is not the same thing as imitation (Strauss, 2017). When an animal or person imitates the behaviour of a model, they mimic or copy the behaviour of the model. However, when observational learning occurs, the behaviour observed is not necessarily repeated. Imagine instead that the scenario described above ended with the instructor humiliating your classmate for asking a question ("*If you had read the assigned readings you would not have to ask such a ridiculous question*"). You would learn *not* to ask questions, thereby learning not to repeat your classmate's behaviour; that is, you have learned not to imitate.

Observational Learning and Aggression

Some of the most famous experiments of observational learning in children were carried

out by psychologist Albert Bandura (born in Mundare, Alberta). Bandura was interested in whether children learned aggressive behavioural responses by observing aggression. He showed children a movie of a woman beating up an inflatable clown punching bag, called a Bobo doll (see **Figure 7.6**) (Bandura, Ross, & Ross, 1961). After the movie, the children were allowed to play in a room full of toys, including a Bobo doll. Those who had previously watched the Bobo video were twice as likely as those who did not watch it to display aggressive behaviour toward the doll.

© Dr. Albert Bandura, Stanford University

FIGURE 7.6 Aggressive modelling Bandura found that children learned to abuse an inflatable clown doll by observing an adult model hit the doll.

Bandura and his colleagues further investigated whether observational learning would be influenced by information about reward and punishment. Indeed, they found such a relationship. The children who saw a video in which beating up the Bobo doll led to rewards to the model, such as candy and praise, were more likely to act aggressively toward the doll than those who observed the model being punished for beating up Bobo (Bandura, Ross, & Ross, 1963). This type of learning is called **vicarious learning** because an individual acquires knowledge by observing (i.e., through the process of observational learning) what happens to a model. The individual then modifies his own behaviour based on this knowledge, choosing to imitate the model or deliberately choosing not to behave like the model (to avoid the same punishment). For example, Mei might get good grades if she observes and imitates Yenay's effective study strategies.

vicarious learning learning that occurs when an individual observes the consequences to another's actions and then chooses to duplicate the behaviour or

refrain from doing so.

Bandura's studies, and a great deal of research that followed, raised concerns about the role that violence on television, in movies, and in video games plays in promoting aggressive behaviour among viewers, especially children (Bandura, 1978). Some studies have demonstrated a convincing link between excessive television watching and physical and relational aggressive behaviour in children (Ostrov, Gentile, & Mullins, 2013). The number of violent acts in a short stretch of children's programming can be disturbingly high. One study reviewed 23 popular animated films and concluded that the overall frequency of violence could be disturbing to young children (Turkmen, 2016). Further, the number of such violent acts is typically highest in cartoons where there are no real consequences for violent behaviour. In fact, cartoon characters seem to have many lives, often returning unscathed after experiencing what would be horribly damaging events in reality. Ian Colman from the University of Ottawa and colleagues published data indicating that important characters in animated films for children were more likely to be murdered or die an early on-screen death than are characters in dramatic films for adults (Colman et al., 2014).

Neuroscientists believe that the neural basis for imitation and observational learning is **mirror neurons** (Rizzolatti & Sinigaglia, 2008; Rizzolatti, Fadiga, Fogassi, & Gallese, 2002; Rizzolatti, Fogassi, & Gallese, 2001). These neurons were discovered by accident by researchers at the University of Parma in Italy who noted the neuronal response of a monkey at rest when it observed a researcher carrying out a similar action to the experimental task it had been carrying out earlier. These mirror neurons not only fired when the monkey reached for an object or grasped or held an object but also fired when the monkey watched another monkey or human carry out the same task (Rizzolatti et al., 2001). fMRI scans and PET scans show that analogous mirror neurons also exist in humans (Catmur, Press, & Heyes, 2016) and are important for social learning, language, and the development of empathy (Campbell & Cunnington, 2017; Spaulding, 2013). (See Indigenous Experiences 7.2.)

mirror neurons neurons fired when an animal or human performs an action or when they see another animal perform the same action.

7.2 Indigenous Experiences

Effects of Residential Schools on Long-Term Success

Through association, reinforcement, and observation, we learn to become what we are told we will become, what we are taught to become by experience, or, in spite of what we experience, what we know. Many children in the residential school system developed a sense of helplessness, anger, and fear that permeated their lives as adults. Only a small minority of these children experienced appropriate levels of care and attention. Instead, most were neglected and abused, and so continue to suffer damage from these early experiences (Wilk, Maltby, & Cooke, 2017). Below are three stories of three people telling three different, yet similar, stories:

Walter Jones said that he and the boys he went to residential school within Alberni, B.C., were told that they would never succeed. “That had a lot of, I guess, a lot of things they did, like, teaching us our, like, to not speak our language, getting strapped for it, and telling us that we’re never going to be able to take the good jobs and stuff like that, and it happened. These things happened, and they, we lost so many of our people because of that residential school thing” (Jones, 2012, p. 123–124).

Madeleine Dion Stout remembers a teacher at the Blue Quills residential school, in St. Paul, Alberta, with fondness. “She really affirmed my existence. She affirmed my quest for knowledge, and, and just wanting to learn as much as I could” (Dion Stout, 2010, p. 125). However, Dion Stout believes that her academic success originated, not from the residential school, but from another source. “It’s not residential school that made me a good student. My, the fundamental values and good example I had before I went to residential school by my grandfather and my parents, and all the old people on the reserve where I grew up are the ones who made me a good student . . . So that I was successful in school, and that I’m successful today academically, people might say, is not because I went to residential school; it’s because I had, from a very early age, I was taught by example and through oral tradition how to live my life” (Dion Stout, 2010, p. 127).

Starting in February 2019, Glenn Courchene, an Anishinaabe from Sagkeeng First Nation in Manitoba, walked seven kilometres every day to get to school. On November 18, 2020, at 61 years of age, he received his high school diploma. Like many in his age cohort, he attended a residential school as a child, the Fort Alexander Indian Residential School, where he was abused. “We couldn’t learn because of what happened to us. We were abused, physical and all that. We were there to learn, not to get hurt” (Monkman, 2020). But Courchene did not let these early experiences deter him. He now plans to attend university and get a bachelor’s degree. “I’ve gone through a lot of hurt, and I respect myself for going to school. And I will never give up school because I want to keep learning” (Monkman, 2020).

Source: CBC

Never too late Glenn Courchene, high school graduate, says “Now I can prove that an elder like me could graduate. If anybody like me can do it, they can do

it" (Monkman, 2020).

Critical Thinking Questions

What do you think that Walter Jones (2012) meant by "we lost so many of our people because of that residential school thing?" What role did learning play in this outcome?

Which kind of learning do you think was primarily responsible for Madeleine Dion Stout's (2010) school success? Why? What other type(s) of learning was/were important?

How do you think that learned helplessness played a role in Glenn Courchane's learning as a youth?

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

8. What is observational learning and what does it demonstrate when it happens?

9. What has research shown about media violence and aggressive behaviour in child viewers?

10. What is spatial navigation learning and why is it difficult to explain using operant conditioning?

What Do You Think? • How might the media be used to get children—or adults—to mimic positive social behaviours?

Learning and Cognition

LEARNING OBJECTIVE 5

Define spatial navigation learning, implicit and latent learning, and insight learning.

Despite the fact that during the twentieth century some prominent behaviourists argued that everything we do comes about as a result of either classical or operant conditioning, some research has shown that learning can occur without any obvious reinforcement. Learning that occurs without awareness is referred to as **implicit learning**. Although the topic of implicit learning is somewhat controversial, proponents argue that there are many examples of implicit learning (Howard & Howard, 2016).

implicit learning the acquisition of information without awareness.

Spatial Navigation Learning

One good example of learning without awareness arose from laboratory studies designed to assess the ability of reinforcement to train rats to learn information about spatial navigation. Laboratory rodents can be trained to navigate through a maze by providing them with reinforcement as they move through the maze. This approach is called **spatial navigation learning** (which is a form of shaping), and it involves the presentation of food rewards as rats move in the correct direction. Rats learn mazes very quickly when reinforced. (As it turns out, so do humans; see Your Brain and Behaviour 7.1, for a discussion of spatial navigation in a common human setting.)

> **spatial navigation learning** learning that involves forming associations among stimuli relevant to navigating in space.

However, in the absence of reinforcers, rats typically explore a maze, but may not be motivated to find the quickest route from start to finish. Tolman (1948) and Tolman and Honzik (1930a; 1930b) carried out what are now considered by many to be classic research studies in this area. They had groups of rats run a maze over a number of trials. The first group of rats was given a reward each time they completed the maze. This group of rats progressively improved in the time it took to complete the maze over time. A second group of rats was never given any rewards and their performances were roughly the same in all trials of the experiment. The final group of rats was not reinforced in the trials in the first half of the experiment but was reinforced in the trials in the second half of the experiment. This final group of rats showed a dramatic improvement in the time it took to complete the maze once they began to receive reinforcement for completing the maze. Tolman and Honzik argued that this dramatic increase in performance demonstrated that the rats had learned and retained information about the layout of the maze, forming a *cognitive map* of the maze, as they explored it without reinforcement and were able to run the maze quickly once given incentives. They argued that when reinforcement was introduced, the rats demonstrated their previous latent learning (Tolman & Gleitman, 1949). **Latent learning** occurs without any obvious reinforcement and is often used as evidence that learning and performance are not the same things. Tolman's work is often used to challenge the behaviourist claim that all behaviour and learning is due to reinforcements and punishments because their work, they claimed, proved that reinforcements were not necessary for learning to occur (Gershman, 2017).

> **latent learning** a form of learning that is not expressed until there is a reward or incentive.

Courtesy of the American Philosophical Society

"Ah-ha" During the 1920s, psychologist Wolfgang Kohler conducted pioneering studies on insight learning. Here, one of Kohler's chimpanzees piles three crates on top of each other to reach a banana that had been placed out of its reach. When first confronted with this complex task, the chimp sat and contemplated the situation; then, in an apparent flash of insight, it stacked and climbed up the crates.

Other researchers argue that there are alternative explanations for latent learning, other than cognitive maps, that can be used to explain the results from Tolman's experiments. They argue that Tolman's results do not prove that reinforcement did not play a role in learning prior to the incentive of food and argue that other plausible explanations can be employed to explain Tolman's data (Redish, 2016). Although the scope of this discussion goes beyond this chapter, it is important to know that this debate is unresolved.

Insight Learning

In addition to spatial navigation learning, there are other types of learning that are also often explained in terms of more cognitive (involving conscious intellectual activity) approaches to learning. One example of this type of learning is **insight learning**. Most of us have had experience with insight learning. When faced with a difficult problem, we may puzzle and struggle over it, unsure how to find a solution. Then, later—perhaps while we are not even working on the problem—we may have an "ah-ha!" or "eureka" moment when the solution suddenly pops into our mind (see photo). Some individuals even report solving problems in their dreams (Schredl, 2015). The Nobel laureate Otto Loewi, the discoverer of the actions of neurotransmitter chemicals, claims to have come up with his definitive study

while sleeping, after pondering the question over and over while awake (Loewi, 1957). Although finding the solutions to our problems in our dreams is fairly rare, insight learning is widespread and is another type of learning that doesn't involve any obvious reinforcement.

insight learning a sudden realization of a solution to a problem or leap in understanding new concepts.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

11. When rats that have been allowed to wander around a maze without food rewards are provided with food rewards at the end of the maze, how does their wandering behaviour affect their learning and running of the maze?

12. Describe the difference between learning something by trial and error and learning it through insight learning.

What Do You Think? • Does it make sense to argue that all learning involves some form of reward or punishment?

Factors that Facilitate Learning

LEARNING OBJECTIVE 6

Define massed and spaced practice and tell what conditions are best for learning semantic material, such as facts in your classes.

It's clear that we can learn in a variety of ways: through simple habituation and sensitization, by linking stimuli in classical conditioning, by associating our behaviour to its consequences through operant conditioning, or by using our observations of the consequences of another's behaviours as a model for our own. We also know that several factors can affect how well each of these learning methods works. Timing, as we have seen, is crucial in classical conditioning. It can also affect other types of learning. The amount of attention we pay when trying to learn is another factor that can facilitate, or alternatively, impede our learning, depending on the type of learning.

Timing

You have probably noticed that you learn more information when you study for an exam over an extended period of time, as opposed to cramming for the test by pulling an "all-nighter" (see photo). Why is this?

Phanie/Phanie/SuperStock

Oh, those all-nighters! Cramming for a test the night before an exam leads to the acquisition of less information than studying for the test over an extended period of time and results in loss of sleep as well.

Much of the learning that you, as a student, undertake on a daily basis involves acquiring information about facts. Psychologists distinguish between this type of learning, called *semantic learning*, and *episodic learning*, which is learning about events in our own lives. We will return to the distinction between episodic and semantic learning in the next chapter dealing with memory, but we can offer some advice now about how to improve your learning of semantic material.

Most importantly, repetition helps (Kang, 2016). Semantic learning is facilitated by multiple exposures to the same material, such as reading the textbook, then listening carefully in class, and then reviewing your notes and textbook. Multiple exposures make it more likely that learning will occur, compared to a single exposure, such as just reading the book or just going to class.

Your learning will also be facilitated by having time intervals between these exposures. When learning trials occur close together, as they do when you try to cram reading the book and reviewing all into the night before a big test, they are referred to as *massed*. When they are separated in time, they are referred to as *spaced*. The difference in efficiency between massed and spaced trials for learning has been demonstrated not only in the laboratory, but also in real life (Smolen, Zhang, & Byrne, 2016). Massed studying, or cramming, is ineffective for two reasons. First, it does not allow enough time between learning trials to maximize learning, and second, it leads to sleep deprivation, which affects the consolidation of learning (Cousins et al., 2019). Learning continues outside of college and university. In fact, a lot of learning takes place at work as the Psychology@Work video on Training Program Design and Evaluation shows.

Video **PSYCHOLOGY@WORK**

Training Program Design and Evaluation This video focuses on the work that

industrial/organizational psychologists do in advising and supporting employers in how they train new employees for their jobs. These psychologists also develop training programs in response to evolving or shifting company and market needs.

Context

Psychologists have long recognized that context plays an important role in learning and remembering. For example, if you take a test in the same location in which you learned the material, you are more likely to do your best. If you want the information to stick with you beyond the end of the semester, however, you may want to move to different locations during your study periods. Research has shown that studying in several different locations increases the likelihood that you will form strong memories about the information. This phenomenon relates to the *context effect*—if you learn information in only one context (for example, in the classroom) you may be less likely to recall it when you are in a different location (at a job interview or while taking a standardized test for graduate or professional school). If you learn the information in multiple locations, then that knowledge may be less tied to the place in which it was acquired, and it may be more readily recalled later (Trueblood, Brown, Heathcote, & Busemeyer, 2013; Wang, Solloway, Shiffrin, & Busemeyer, 2014).

Awareness and Attention

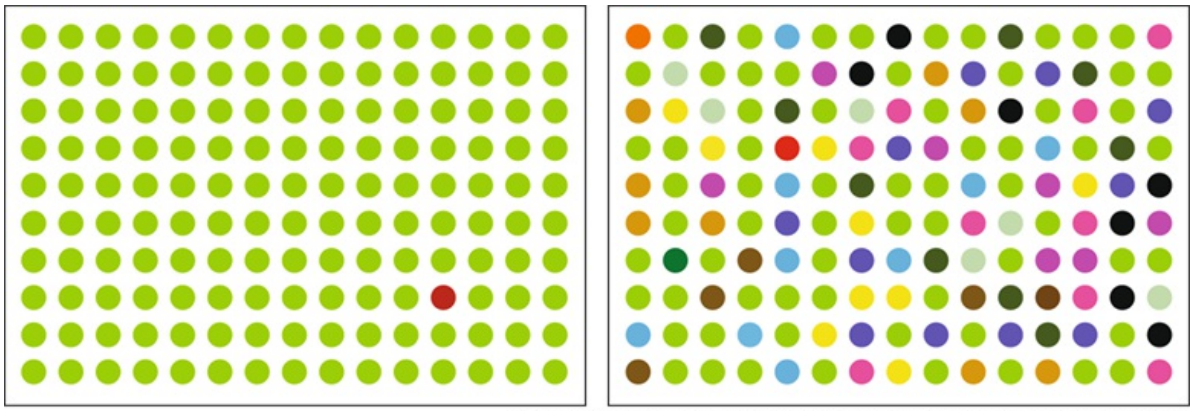
Learning can occur without awareness. In most instances, however, awareness and attention enhance learning. Many forms of associative learning, including semantic and episodic learning, require awareness and are greatly enhanced by attentional processes. Because attention is so important to learning, it is worth considering an important question: how does attention work? Scientists have found that the answer to this question depends on the circumstances. Some attentional processes are automatic and occur when a particular stimulus is very different from those that surround it. Psychologist Anne Treisman, while working at the University of British Columbia, studied attention to visual stimuli and showed that in the case of a simple scene, if one stimulus differs considerably from others, it will immediately grab our attention, a phenomenon referred to as "*pop-out*" (see **Figure 7.7**). In order for pop-out to work, the stimulus must be singularly different from the surroundings (see Lagroix, Di Lollo, & Spalek, 2015; Craik, 2014; Treisman & Kanwisher, 1998). As scenes get more and more complicated, pop-out is less likely to help in guiding attentional processes. Instead, we must rely on an active searching method, where we examine material in search of the most relevant stimuli. Anyone who has enjoyed children's books such as "Where's Waldo" or "I Spy," where a relevant stimulus is buried in a complex visual scene, has engaged an *active searching* attentional process. Recall from Chapter 5 the distinction between bottom-up and top-down processing. Pop-out, because of its simplicity and speed, employs bottom-up processing; active searching, because of the need to draw on cognitive processes and memory, uses top-down processing.

Sometimes attentional processes can get in the way if information is inherently contradictory; for example, attending to one stimulus can block our ability to attend to another stimulus. A good example of this is the *Stroop Effect*, a psychological test that

involves presenting a list of words printed in different colours (see illustration). Each of the words is a colour word (for example green, red, black, blue). In one task the colour of the word and the colour of the ink the word is presented in match (for example the word "red" is presented in red ink); but in the other task, the colour word is printed in a colour that differs from that of the word (for example, the word "red" is presented in blue ink). Participants are asked to name the colour the word was printed in regardless of the name of the word (that is, if the colour "red" is in blue ink, the participant should say "blue"), thus ignoring the word. This task is difficult because it is easier for us to more quickly and automatically read words than it is to name colours, and that automatic process interferes with the more effortless task of naming the word (Kiyonaga & Egner, 2014).

The Stroop Effect **The Stroop Effect illustrates how when information is inherently contradictory (the word "red" presented in blue ink), attending to one stimulus (the word "red") can block our ability to attend to the relevant task (naming the colour "blue").**

What can we do then to maximize our attention to relevant information while trying to learn? First, it's a good idea to identify relevant information and focus on it throughout your reading. If your professor mentions topics repeatedly in class, you might use an active searching method to find additional similar material in your readings. Second, avoid dividing your attention. Our attentional processes are generally at their best when they are focused on one task (Calderwood, Ackerman, & Conklin, 2014). Performing other behaviours, such as answering text messages or watching TV while trying to study, usually interferes with our ability to attend to relevant material. In fact, one study showed that people who engage in a high degree of "multi-tasking" on laptops while in lectures have lowered levels of comprehension than those engaged in more focused learning (Sana, Weston, & Cepeda, 2013).



Source: Dr. Gijsbert Stoet, www.psytoolkit.org/lessons/visualsearch.html

FIGURE 7.7 Pop-out effect Finding the red circle is easier in the square on the left. This is called the "pop-out" effect. Source: Dr. Gijsbert Stoet, www.psytoolkit.org/lessons/visualsearch.html

Social Networking and Multi-Tasking

According to reports, students who use Twitter and Facebook while they study and attend lectures get lower grades than those who don't (Ozer, Karpinski, & Kirschner, 2014; Tess, 2013; Junco, 2012; Junco & Cotten, 2012). Specifically, research has shown that students who had Facebook or other forms of social media running while they studied—even if it was simply running in the background—tended to have lower grade point averages and fewer study hours than students who were not similarly distracted. Moreover, research from Farina Sana from McMaster University and her colleagues, Tina Weston and Nicholas Cepeda from York University, also indicate that students who use social media in class not only harm their own learning but negatively affect the learning of their peers. Their data indicate that comprehension is impaired for peers in view of classmates who are multi-tasking on a computer during a lecture (Sana et al., 2013). It is also worth noting that students themselves don't seem to be aware of this problem. More than three-quarters of Facebook users said they didn't think the practice of multi-tasking has any negative effects on their studying.

One interpretation of these results is that Snapchat, Instagram, Twitter, Facebook, and other social media are so distracting that they prevent the focused attention necessary for effective studying; however, it is also possible that students who use Facebook while studying are weaker students with poorer study habits to begin with. It is additionally possible that distraction (divided attention) may not be the entire explanation for grade differences; instead some data suggest that heavy use of the Internet, including Facebook, may lead to changes in how people actually process and remember information (Small & Vorgan, 2008; Frein, Jones, & Gerow, 2013). That is, it may be that the very nature of surfing the Internet alters the way we learn. We are largely left to speculate as causal explanations of these data are difficult to obtain and it is extremely challenging to carry out experimental research on this topic because it is almost impossible to identify a control group that has never used social media, including Facebook (Frein et al., 2013).

iStockphoto.com/Yuri_Arcurs

Sleep deprivation, attention, and learning **Sleep deprivation makes it difficult to pay attention, thus impairing our ability to learn. In addition, sleep deprivation after learning reduces our ability to retain newly-learned material.**

Sleep

Studies have shown that sleep is important for learning and memory (this was discussed also in Chapter 6). Sleep deprivation impairs our ability to pay attention and learn (see photo). In addition, sleep deprivation can prevent learned information from moving into more permanent long-term memory storage. Studies in both humans and experimental animals have confirmed that sleep deprivation interferes with learning and memory (Schönauer & Gais, 2017; Casey et al., 2016; Melo & Ehrlich, 2016) and increases vulnerability to stress (Schwarz et al., 2016). (As you will see in Chapter 8, memories are thought to leave physical traces in the brain—called *memory traces*.) So while staying up late to study may be unavoidable at times, try to get a decent amount of sleep so that you don't forget what you are staying up late to learn and ensure that you will be alert enough to learn even more new information the next day and be able to handle any new stresses that might arise.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

13. Which would be better for helping you learn psychology facts: massed or spaced practice? Why?

14. What kinds of learning benefit from focused attention?

What Do You Think? • How could you modify your own schedule or study habits to allow for spaced practice of your material or to take advantage of your most alert and attentive times of day?

Prenatal and Postnatal Learning

LEARNING OBJECTIVE 7

Summarize the types of learning that occur before we are born and during early postnatal life.

Several studies suggest that non-associative learning can occur before infants are even born. Fetuses show habituation and sensitization to smells and other sensory stimuli (Faas et al., 2015). In one set of studies, for example, infants who had been prenatally exposed to garlic—through their mothers' digestion—showed evidence, after they were born, of recognizing the garlic odour. They did not try to avoid the smell, as babies new to garlic typically do (Schaal, 2016).

A.N. Meltzoff & M.K. Moore, "Imitation of facial and manual gestures by human neonates." Science, 1977, 198, 75–78

Infant imitation **In a series of classic studies, Meltzoff and Moore (1977) found that newborns could imitate facial movements, such as tongue protrusion, mouth opening, and lip pursing.**

Humans are also capable of basic associative learning before birth. One team of researchers reported classical conditioning of human fetuses. These researchers paired specific music (initially a neutral stimulus) with relaxation exercises done by the mother. The maternal relaxation exercises served as an unconditioned stimulus, often leading to a slowing of fetal physical activity (an unconditioned response). After enough pairings of the music and the relaxation, the music became a conditioned stimulus, leading directly to a decrease in fetal movement (CR), with or without the relaxation exercises (see Gebuza et al., 2016 for

review).

Further, in a groundbreaking study Andrew Meltzoff and M. Keith Moore (1977) demonstrated that within hours of birth, infants were able to imitate facial expressions, clearly demonstrating the ability to mirror the behaviour of another person without learning (see photos). This task has been replicated in other primates as well. Other research has shown that young children learn language best from face-to-face interactions rather than from video or television, emphasizing the role of social learning in cognitive growth and development (Conboy, Brooks, Meltzoff, & Kuhl, 2015; Ramírez-Esparza, García-Sierra, & Kuhl, 2014). See Positive Psychology 7.2 to see another form of social learning.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

15. What kinds of learning can happen before we are born?

What Do You Think? • What are the advantages and disadvantages of having only very simple forms of learning intact during fetal life? What consequences would arise if we possessed intact learning about events before birth?

7.2 Psychology Around Us | Positive Psychology

Children Teach Kaspar the Robot Using Reinforcement

The field of social robotics has expanded over the last decade to support children diagnosed with autism spectrum disorder (ASD) to mediate relationships with others (Tapus et al., 2020). ASD is characterized by impairments in social interaction, deficits in social communication, and restricted and repetitive patterns of behaviours and interests. It has been speculated that humanoid robots appeal to children with ASD because the robots have predictable behaviours and simplistic appearances, with basic features and minimal facial and body expressions.

A group of researchers from the University of Hertfordshire in the UK employed a "learning by teaching paradigm" with children with and without symptoms of ASD. The 7- and 8-year-old children provided a humanoid Kaspar robot (Wood, Zaraki, Robins, & Dautenhahn, 2019; Wood et al., 2017) with positive or negative feedback to teach the robot arbitrary associations about toys and locations. The teaching task was intended to encourage collaboration, so the children worked in pairs or groups of three. The goal of the research was to facilitate social skill development in children. Over the series of trials, Kaspar was programmed to verbally express uncertainty so that the children would be better informed of the robot's progress. The researchers put the children in control of Kaspar's learning so that they could develop social skills and collaborative abilities while teaching the robot as a team. During each trial, Kaspar would guess the name and location of a particular toy and the children would then

press a green button for a correct response or a red button for an incorrect response. The robot then used this information to formulate its next response. However, the robot was also programmed to make mistakes so that the children would have opportunities to provide correct feedback. All children, both those typically developing and those diagnosed with autism, were able to teach Kaspar each association in two to seven trials.

Given that the novel protocol was shown to be effective with both typically developing children and with children diagnosed with ASD, Tapus and colleagues plan to expand the scope of the next experiment by using a longitudinal design to assess children's improvements in social interaction over time. The researchers speculate that because Kaspar is minimally expressive, children with ASD find him more comfortable to interact with than an actual human. The researchers' hope is that once the children with ASD develop social skills with Kaspar, they will be able to apply those skills in more complex environments and be better able to socially interact with peers and family. For further information on Kaspar and the University of Hertfordshire's research initiative, go to www.herts.ac.uk/kaspar/meet-kaspar.

AP Images/Alastair Grant

"Peek-a-boo Kaspar" Interacting with Kaspar the robot helps children diagnosed with ASD to develop a better understanding of human emotions.

Specific Learning Disorder

LEARNING OBJECTIVE 8

Define specific learning disorder and describe three major types of learning disorders.

Although there is no consistent definition of learning disorders in Canada, it is estimated that approximately 4.9 percent of Canadian school-age children (ages 6 to 15 years) and half a million adults in Canada live with a learning disability (Stegemann, 2016). However, in 2015 the Learning Disabilities Association of Canada endorsed a commonly accepted

definition that includes characteristics such as average or above-average intellectual ability, with focused impairments affecting one or more areas of academic achievement, such as reading comprehension, mathematical computation, and written expression (Fiedorowicz et al., 2015; Hutchinson, 2014). Learning disabilities are lifelong. Many children with diagnosed learning disorders are high achievers and go on as adults to have successful lives and careers. However, many are prevented from realizing their full potential and therefore fail to reach typical levels of achievement.

The Learning Disabilities Association of Canada requested access to Statistics Canada data surveys. It analyzed 10 different data sets and then released a federally-funded report, "Putting a Canadian Face on Learning Disabilities (PACFOLD, 2007)." The data show that slightly over 28 percent of those with learning disabilities aged 22 to 29 years of age report less than a high school diploma (as compared to about 11 percent in the general population for the same age group). Learning problems are typically undetected until children are in Grade 5 and problems compound with age and affect every aspect of development. As adults, people diagnosed with learning disabilities are likely to have lower levels of literacy, less likely to be employed, and more likely to suffer from mental health issues than those in the general population. The authors of the study indicate that blame cannot be placed solely on the education system, and they call for a solution involving a broader public policy approach, including mandatory screening of children 4 to 8 years old, public funding for education and educational support, as well as greater education so as to increase awareness for educators and employers. The entire report can be accessed at www.pacfold.ca.

The term *learning disability* is not included in the *Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5)* but most health professionals use it to group together three sets of disorders that do appear in the *DSM-5*: learning disorders, communication disorders, and motor skills disorders (Davison, Blankstein, Flett, & Neale, 2014). A **specific learning disorder** is described in the *DSM-5* as a disorder in one or more of the basic psychological processes involved in spoken or written language. It manifests as difficulty in specific aspects of learning and using academic skills, such as listening, thinking, speaking, reading, writing, spelling, or carrying out mathematical calculations. These symptoms must persist for six months or more despite interventions targeting those difficulties, and exclude learning problems that are primarily due to visual or auditory problems, intellectual impairment, and emotional disturbance, or of environmental, cultural, or economic disadvantage. The DSM-5 also specifies that those with specific learning disorders must have at least average abilities essential for thinking or reasoning. Therefore, specific learning disorders are distinct from intellectual developmental disorders (American Psychiatric Association, 2013).

> **specific learning disorder** a disorder that interferes with the acquisition and use of one or more of the basic psychological processes involved in the development of academic skills: oral language, reading, written language, and mathematics.

The previous *DSM*, the *DSM-IV-TR*, divided learning disorders into three categories: reading disorders, mathematics disorder, and disorder of written expression. Although the *DSM-5* does not use this system of categorization, it is a useful way to examine each of these

specific disorders and will help to provide you with a feel for the types of disorders that can occur under the more general heading of specific learning disorder. It is important to note that these disorders can occur independently or in combination and that other learning difficulties also exist. As well, note that there is no single type of disability, even within categories; symptoms vary from one individual to the next.

Phanie/SuperStock

Studying reading disorder **A range of factors have been proposed to explain dyslexia, a deficiency in the ability to read, including deficits in visual processing, speech skills, auditory processing, and object or letter identification. Here a child diagnosed with the disorder undergoes a reading test with prism glasses.**

The most common form of learning disorder is a **reading disorder**, known in international diagnostic classifications as *dyslexia*, a deficiency in learning to read (see photo). A reading disorder involves deficits in reading comprehension, written spelling, and word recognition. There is some evidence that the same people with dyslexia have visual processing deficits that may produce perceptual problems, which in turn contribute to their difficulty in recognizing written words. Neuroimaging studies comparing children with dyslexia to those without the disability have shown that some children with dyslexia have reduced blood flow in brain regions associated with acquisition of reading skills, such as the left parietal and temporal cortex (Finn, Lee, Kraus, & Kam, 2014). Most people with dyslexia overcome their difficulties in learning to read with the help of extensive tutoring and specific educational programs.

reading disorder a deficit in reading comprehension, written spelling, and word recognition.

A somewhat less prevalent learning disorder is a condition known as **mathematics disorder**, known in international diagnostic classifications as *dyscalculia*. Individuals with this specific learning disorder experience difficulty performing simple mathematical equations, recalling math symbols, counting numbers accurately, and quickly recalling mathematical facts or solving word problems, as well as difficulty understanding graphs

and other problems related to numeracy. Some evidence suggests that parts of the left parietal and frontal cortex of the brain are less active in individuals with dyscalculia (Rapin, 2016; Kucian, 2015). As with dyslexia, intensive tutoring and specific educational programs can help students with dyscalculia learn mathematical information (Butterworth, 2010; Butterworth, Varma, & Laurillard, 2011).

> **mathematics disorder** a deficit in mathematical ability, including the ability to do calculations, as well as the ability to understand mathematical word problems and mathematical concepts.

Disorder of written expression is the least understood of the specific learning disorders. This disorder is known in international diagnostic classifications as *dysgraphia* and is experienced as impairment in the ability to create the written word. Individuals with this specific learning disorder experience difficulty communicating in writing, exhibit poor handwriting, struggle with spelling and grammar, and have difficulty organizing and expressing thoughts and ideas in written composition. It is unclear whether disorder of written expression occurs independently of reading disorder or communication (language) disorders (Davison et al., 2014). The causes of the disorder is largely unknown. It may be that different forms of the disorder have specific underlying explanations.

> **disorder of written expression** a disorder experienced as impairment in the ability to create the written word.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

16. What are dyslexia and dyscalculia?

What Do You Think? • What, in your opinion, is the purpose in collapsing all three categories of learning disorders into one category in the *DSM-5*?

7.1 Your Brain and Behaviour

Learning to Play a Video Game

You need to find that key, but watch out for those obstacles!

How do we learn to navigate through virtual reality, avoiding dangers that prevent us from moving through the game to mastery? What parts of the brain enable us to learn the rules of the game and respond to changes in the electronic world as we play?

When we learn a new video game that involves spatial navigation through a virtual three-dimensional space, trying to avoid punishments and obtain rewards all along the way, we are engaging a number of neural circuits throughout the brain. First, spatial

navigation learning requires inputs from the visual cortex to the hippocampus and temporal lobe. Second, learning about rewards involves dopamine projections extending from the ventral tegmental area to the nucleus accumbens and prefrontal cortex. And third, integration and long-term storage of the information from these systems involves other cortical regions, including the parietal and temporal cortex. These changes in the brain take place as you learn the game—as your skilled movements become more automatic, brain activity shifts to the corpus striatum (basal ganglia). Will you make it to the next level?

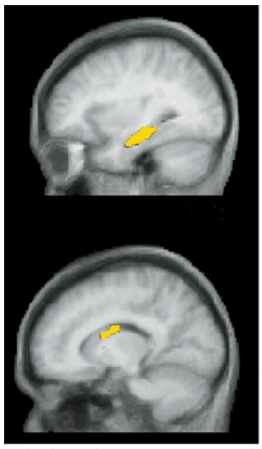
Questions

How do brain activation patterns differ when one is using a 3D versus a landmark strategy for navigation?

Which brain region creates new neurons as we develop spatial navigation skills?

Which neurotransmitter is affected by our learning about rewards, such as those received during video game play?

UfaBizPhoto/Shutterstock.com



Picking a strategy People use different strategies to solve tasks that involve navigating in space. Some people use a 3D strategy, using their position relative to the environment to find their way. Others use landmarks and numbering strategies (for example, enter the second door on your right). The different strategies engage different neural systems, shown on these fMRI images. Spatial 3D strategies activate the hippocampus (see top left photo, yellow) while landmark strategies activate the basal ganglia (see bottom left photo, yellow) (Clemenson & Stark, 2015).

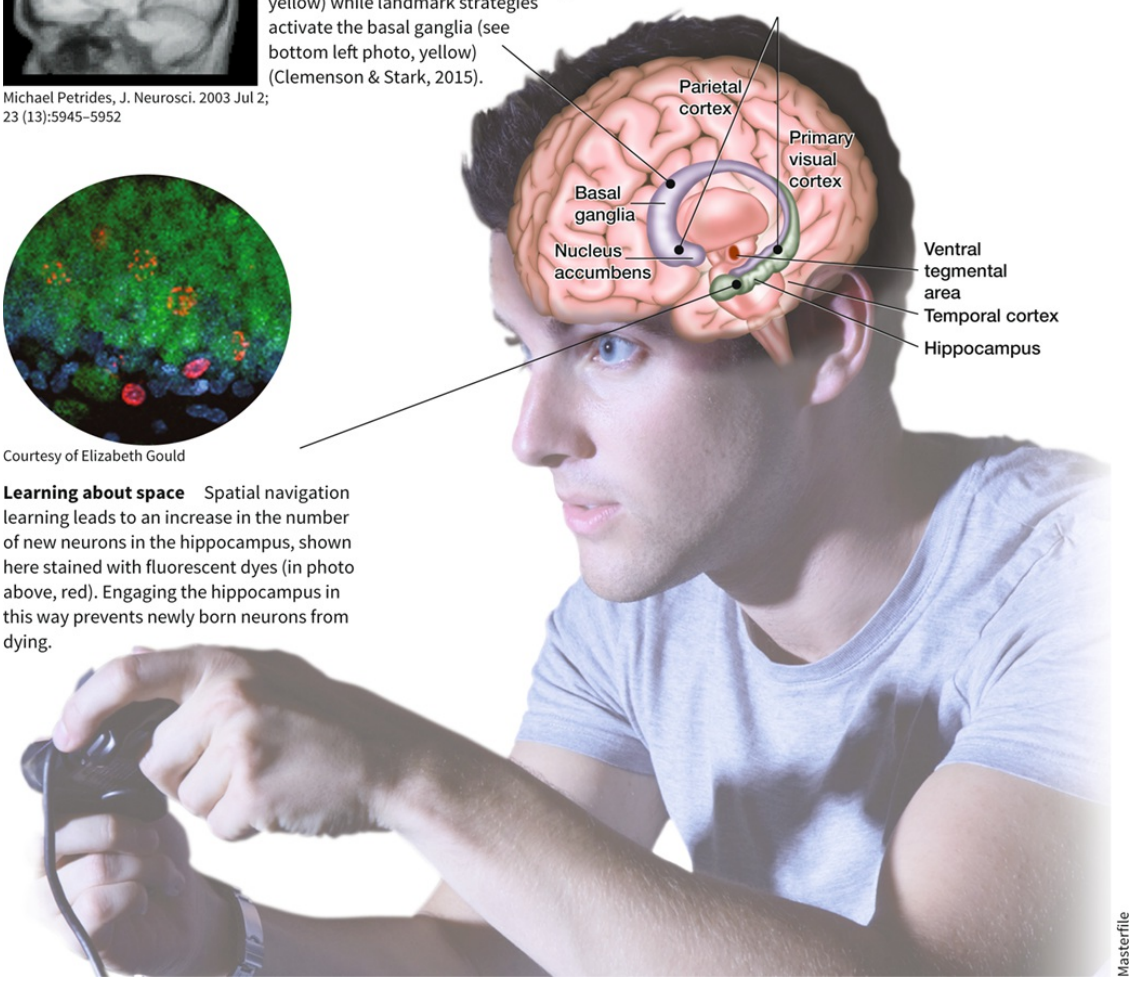
Michael Petrides, J. Neurosci. 2003 Jul 2; 23 (13):5945–5952

Courtesy of Elizabeth Gould

Strengthening your synapses When you learn a task that involves spatial navigation and reward, synapses in a number of brain regions, including the hippocampus and nucleus accumbens, likely undergo long-term potentiation (LTP), a form of synapse strengthening. Most postsynaptic sites that undergo synapse strengthening are located on small extensions off of dendrites, called dendritic spines (shown here in above photo labelled with a green fluorescent tracer).

Courtesy of Elizabeth Gould

Learning about space Spatial navigation learning leads to an increase in the number of new neurons in the hippocampus, shown here stained with fluorescent dyes (in photo above, red). Engaging the hippocampus in this way prevents newly born neurons from dying.



Masterfile

Summary

What Is Learning?

LEARNING OBJECTIVE 1 Define learning and distinguish between associative and non-associative learning.

Learning is a lasting change in the brain caused by experience.

Non-associative learning is a lasting change that happens as a result of experience with a single cue. Types of non-associative learning include habituation, in which we display decreased responses to familiar stimuli, and sensitization, in which we display increased responses to stimuli of normal strength after being exposed to an unusually strong stimulus.

Associative learning is a lasting change that happens as a result of associating two or more stimuli. Types of associative learning include classical and operant conditioning.

Classical Conditioning

LEARNING OBJECTIVE 2 Describe the basic processes of classical conditioning and explain how classical conditioning is relevant to learning.

As a result of classical conditioning, a previously neutral stimulus comes to elicit a response by being paired with an unconditioned stimulus (US) that already generates the response, known as an unconditioned response (UR). The neutral stimulus becomes a conditioned stimulus (CS) when it elicits the same response as the US. The response to the CS is known as a conditioned response (CR).

Repeated presentation of the CS without the US can lead to extinction, or suppression of the CR. Extinction does not mean we forget the CS–US association, however. The CR can be spontaneously recovered.

Phobias and conditioned taste aversions can result from classical conditioning. Systematic desensitization uses classical conditioning to extinguish phobia responses. Conditioned taste aversions suggest that we are biologically prepared to quickly learn responses important to our survival.

Operant Conditioning

LEARNING OBJECTIVE 3 Describe the basic processes of operant conditioning and explain how shaping can be used to teach new behaviours.

Operant conditioning is a learned association between stimuli in the environment and our own behaviour. The law of effect states that we learn to repeat behaviours that will increase our rewards and help us avoid punishment.

Reinforcers are rewarding stimuli from the environment. Positive reinforcement provides a desired stimulus; negative reinforcement takes away an unpleasant stimulus. Both increase the chance a behaviour will be repeated. Primary reinforcers are reinforcing in and of themselves. Secondary reinforcers become reinforcing because of their association with primary reinforcers.

Positive punishment provides an unpleasant stimulus; negative punishment takes away a rewarding one. Both types lower the chances that a behaviour will be repeated.

Schedules of intermittent reinforcement provide reinforcements after either fixed or variable intervals of time or numbers of responses. Any intermittent reinforcement modifies behaviour more effectively than continuous reinforcement.

Shaping, or rewarding successive approximations of a behaviour, uses operant conditioning principles to teach new behaviours. People and animals are limited in the

behaviours they can learn, however, by their biological endowments.

Learned helplessness occurs when previous learning that punishment is inescapable interferes with the later ability to learn how to avoid escapable punishment. It may be related to depression or be one way to account for the behaviour of abuse victims.

Observational Learning

LEARNING OBJECTIVE 4 Define observational learning and summarize concerns about observational learning from the media.

Observational learning is learning by watching the behaviour of others. We are more likely to model, or imitate, others' behaviour that we see rewarded.

Many people are concerned that high levels of violence in the media encourage viewers to model such aggression. Studies about the causal nature of media encouraging violence have been inconclusive.

Learning and Cognition

LEARNING OBJECTIVE 5 Define spatial navigation learning, implicit and latent learning, and insight learning.

Learning that occurs without awareness is referred to as implicit learning.

Insight learning and spatial navigation learning seem to take place in the absence of any obvious reinforcement.

Factors that Facilitate Learning

LEARNING OBJECTIVE 6 Define massed and spaced practice and tell what conditions are best for learning semantic material, such as facts in your classes.

Massed practice occurs when learning episodes are closely spaced (e.g., "cramming"); this approach impedes learning.

Repeated, spaced practice aids learning of semantic material, such as classroom information.

According to the *context effect*, if you learn information in only one context, or location, you may be less likely to recall it when you are in a different context.

We can learn without paying attention, but focused attention aids semantic learning.

Sleep deprivation impairs our abilities to pay attention and to learn.

Prenatal and Postnatal Learning

LEARNING OBJECTIVE 7 Summarize the types of learning that occur before we are born and during early postnatal life.

We are capable of non-associative learning, both habituation and sensitization, before birth, as well as basic associative learning, such as classical conditioning.

We become capable of increasingly complex forms of learning as relevant areas of our

brains mature after we are born.

Specific Learning Disorder

LEARNING OBJECTIVE 8 Define specific learning disorder and describe three major types of learning disorders.

A specific learning disorder is a specific deficiency in one or more areas of learning, while learning in other areas takes place normally. Although the DSM-5 does not consider the three categories of learning disability referred to in the DSM-IV-TR, there was discussion of three types of specific learning disorder: reading disorder, mathematical disorder, and disorder of written expression.

Key Terms

associative learning

behaviourism

behaviour modification

classical conditioning

conditioned response (CR)

conditioned stimulus (CS)

conditioned taste aversion

conditioning

continuous reinforcement

dishabituation

disorder of written expression

extinction

fixed interval schedule

fixed ratio schedule

habituation

higher order conditioning

implicit learning

insight learning

intermittent or partial reinforcement

latent learning

law of effect

learned helplessness

learning

mathematics disorder
mirror neurons
modelling
natural reflex
negative punishment
negative reinforcement
non-associative learning
observational learning or social learning
operant or instrumental conditioning
phobia
positive punishment
positive reinforcement
primary punisher
primary reinforcer
punishment
reading disorder
reinforcer
secondary punisher
secondary reinforcer
sensitization
shaping
spatial navigation learning
specific learning disorder
spontaneous recovery
stimulus discrimination
stimulus generalization
systematic desensitization
unconditioned response (UR)
unconditioned stimulus (US)
variable interval schedule
variable ratio schedule
vicarious learning

Self-Study Questions

Multiple Choice

1. How does associative learning differ from non-associative learning?

a. Associative learning is studied experimentally. Non-associative learning is studied using non-experimental methods.

b. Associative learning applies to humans. Non-associative learning applies to other animals.

c. Associative learning is based on connecting two or more stimuli. Non-associative learning is not based on such connections.

d. Non-associative learning involves memory. Associative learning does not require memory.

2. In Pavlov's study, the US was _____; the neutral stimulus was _____; and, finally, the CS was _____.

a. meat powder; the assistant; meat powder

b. meat powder; the assistant; the assistant

c. the assistant; meat powder; meat powder

d. meat powder; meat powder; the assistant

3. _____ occurs when a previously conditioned response decreases in frequency when the CS is presented in the absence of the US.

a. Extinction

b. Habituation

c. Adaptation

d. Deconditioning

4. Paycheques and grades are delivered on a _____ schedule of reinforcement.

a. fixed-ratio

b. fixed-interval

c. variable-ratio

d. variable-interval

5. Which of the following statements best captures the relationship between observational learning and modelling?

a. Observational learning and modelling refer to unrelated learning processes.

b. Observational learning and modelling refer to the same process.

c. Observational learning is evidence that modelling has occurred.

d. Modelling is evidence that observational learning has occurred.

6. For which of the following types of learning are attention and awareness probably most important?

a. semantic learning

b. procedural learning

c. non-associative learning

d. classical conditioning

7. Mirror neurons are believed to be the basis for:

a. negative reinforcement.

b. extinction.

c. habituation and sensitization.

d. imitation and observational learning.

8. The Stroop Effect:

a. illustrates the "pop-out" effect.

b. assesses the ability to inhibit cognitive interference.

c. measures sustained attention.

d. demonstrates that incompatible information has no effect on performance.

9. When does non-associative learning develop?

a. prenatally

b. in the first days of life

c. in the first several months of life

d. in the second year of life

10. Which of the following is not true regarding specific learning disorder as described in the DSM-5?

a. A specific learning disorder must persist for six months or more despite interventions targeting those disabilities.

b. A specific learning disorder is divided into three categories in the *DSM-5*: reading disorders, mathematics disorder, and disorder of written expression.

c. Those with specific learning disorders must have at least average abilities essential for thinking or reasoning.

d. A specific learning disorder is a disorder in one or more of the basic psychological processes involved in spoken or written language.

Fill-in-the-Blank

1. Psychologists use the term _____ to refer to a lasting change in behaviour resulting from experience.

2. In classical conditioning, a previously _____ stimulus is associated with an unconditioned stimulus that naturally elicits some response.

3. Reinforcers that satisfy a biological need are _____ reinforcers.

4. The process of teaching complex behaviour by reinforcing ever closer approximations of the desired behaviour is called _____.

5. Bandura's "Bobo doll" experiments were intended to demonstrate _____.

6. Learning about events in our own lives is called _____ learning. Learning about facts is called _____ learning.

7. A _____ is a disorder in one or more of the basic psychological processes involved in spoken or written language.

8. Human fetuses learn to pair music with relaxation, indicating that they are capable of basic _____ learning before birth.

9. Heavy use of the Internet, including Facebook, may lead to changes in how people actually _____ and _____ information.

10. Research indicates that a human fetus is capable of _____ learning, such as _____ conditioning, prior to birth.

CHAPTER 8
Memory

David Kohler/Mediabakery

CHAPTER OUTLINE

What Is Memory?

LEARNING OBJECTIVE 1 Define the basic activities of memory and describe two major models of memory.

How Do We Encode Information into Memory?

LEARNING OBJECTIVE 2 Describe how information is encoded and transferred among different memory stores and what we can do to enhance encoding.

How Do We Store Memories?

LEARNING OBJECTIVE 3 Describe how we organize and store information in working and long-term memory and how we can enhance our long-term memories.

How Do We Retrieve Memories?

LEARNING OBJECTIVE 4 Describe how we retrieve information from memory and how retrieval cues, priming, context, and emotion can affect retrieval.

Why Do We Forget and Misremember?

LEARNING OBJECTIVE 5 Summarize key theories of why we forget information and sometimes distort or manufacture memories.

Memory and the Brain

LEARNING OBJECTIVE 6 Describe how the brain is involved in memory.

Memories in the Young and Old

LEARNING OBJECTIVE 7 Describe the kinds of memories and memory changes that

characterize early life and later life.

Disorders of Memory

LEARNING OBJECTIVE 8 Describe physical and psychological disorders that disrupt memory.

In the 2004 movie *50 First Dates*, the character Lucy, suffering from a fictitious disorder called Goldfield Syndrome, wakes up each day believing it is the same day that she has the accident that gives her the injury from which she suffers. She cannot convert her new memories into longer lasting memories because of her brain injury, and so is in an eternally looping day. A second character, Henry, meets her and goes on to have a series of repeated dates with her, none of which she can recall.

The idea of the endless day has been repeated in other movies as well, such as *Groundhog Day* (1993), *Memento* (2000), and *Edge of Tomorrow* (2014). In these movies, the main characters differ from Lucy in that they are aware that they are repeating the same experiences again and again.

Consider everything that memory lets you do. Obviously there are the everyday tasks, such as passing tests, turning in a paper on time, or remembering a friend's birthday. But go deeper: think of the things memory lets you do that you take for granted. Because of memory, you can have favourite foods, favourite musicians, favourite movies, and favourite TV shows. Not only can you remember friends' birthdays, you can also remember their typical behaviours and their preferences, and then predict what they might want for their birthday.

You can go deeper still. If you did not somehow encode events and people in your mind, you would not know about anything that you were not directly sensing at that moment. You would only know what was in your line of sight and would have no idea how the things that you were seeing connected to you or had any significance or meaning. Without memory, you would be a stranger to yourself, unable to form the identity, or sense of self, that comes from linking one's present to one's past and using this information to make decisions about the future (Roediger & Craik, 2014). By keeping a record of our past, our memory takes us out of an infinite present.

What Is Memory?

LEARNING OBJECTIVE 1

Define the basic activities of memory and describe two major models of memory.

Simply put, **memory** is the faculty for recalling past events and past learning. This definition is perhaps the only thing about memory that is simple. Although psychologists often differ in their ideas about memory, they generally agree that it involves three basic activities:

Encoding—Getting information into memory in the first place

Storage—Retaining memories for future use

Retrieval—Recapturing memories when we need them

memory the faculty for recalling past events and past learning.

encoding a basic activity of memory, involving the recording of information in our brain.

storage a basic activity of memory, involving retention of information for later use.

retrieval a basic activity of memory, involving recovery of information when we need it later.

For example, when you attend a concert, you may transform the sights and sounds produced by the performing band into a kind of memory code and record them in your brain (encoding). This information then remains stored in the brain until you retrieve it at later times—such as when you see photos of the band online, watch their music videos, or decide which of the band's songs to download. At times of retrieval, the original concert event, including the feelings of exhilaration and joy that you experienced at the concert, may come rushing back.

How do we manage to encode, store, and retrieve information? Psychologists have developed a number of models of explanation, including the *information-processing model* and the *parallel distributed-processing model*, or *connectionist model*.

The **information-processing model** of memory has its roots back in early computer science (Atkinson & Shiffrin, 1968) and was intended to chart the ways that, like computers, humans process information from their senses into memory. The information-processing model of memory holds that information must pass through three stages, or systems, of mental functioning to become a firmly implanted memory—sensory memory, working memory, and long-term memory (see **Figure 8.1**) (Estes, 2014b; Kandel, Dudai, & Mayford, 2014; Dudai, 2011).

information-processing model view of memory suggesting that information moves among three memory stores during encoding, storage, and retrieval.

When we first confront a stimulus, our brain retains a sensory image—or *sensory memory*—of it for less than a second. Sensory memories help us to keep items that we have experienced briefly alive a bit longer. As a result, in a sense we can then decide whether to pay further attention to them. Sensory memories are basically copies of the sensory data we have just received. For example, visual sensory memory is also called *iconic memory*, meaning it is like a small copy of the visual event we have just encountered, just as a computer icon is a small visually descriptive representation of the program or file it represents (Dick, 1974). Similarly *echoic memory* is an auditory system that holds information for a short time. It is hard to know how to describe the capacity of sensory memory, but given that it can contain a complete copy of a sensory input, we assume that it has a large capacity. If, for example, we look up a person's email address, our sensory memory records the address and quickly passes it on to our *short-term memory*. We can

help retain the new address in working memory by concentrating on this information or by repeating it over and over as we address an email or type it into our computer's address book. But short-term memory itself can hold only so many pieces of information at a time. The capacity of short-term memory is often claimed to be five to nine elements of information (i.e., 7 ± 2) (Miller, 1956). More recent estimates put the capacity of working memory closer to three or four elements (Farrington, 2011).

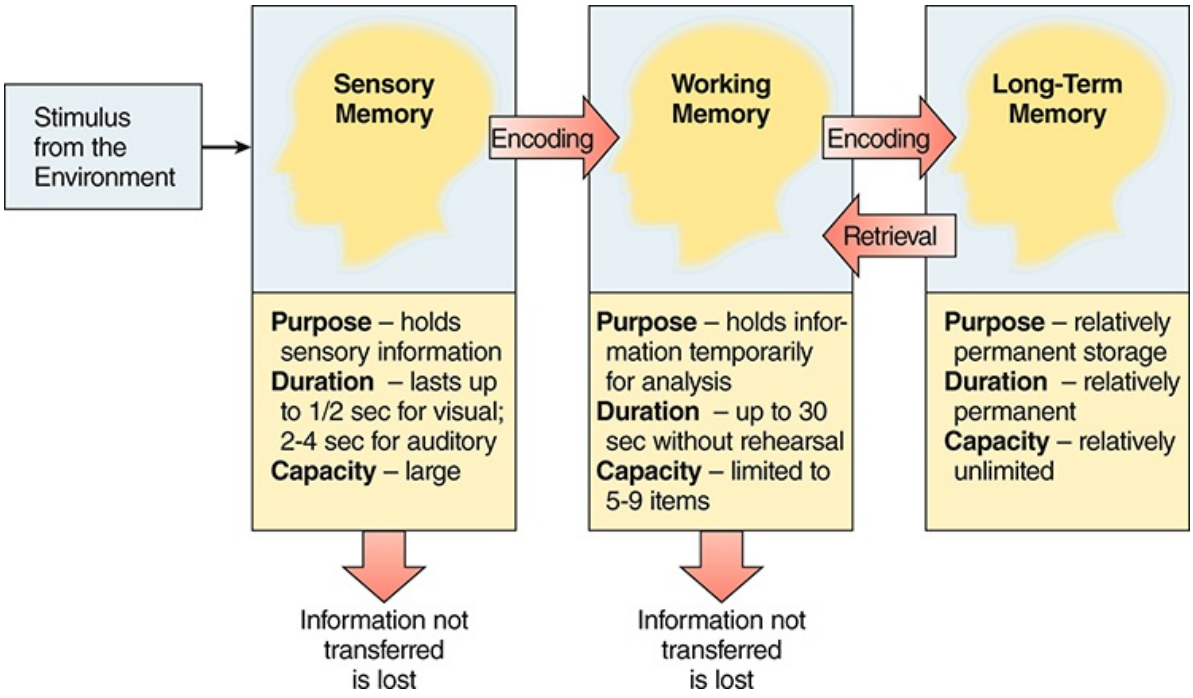


FIGURE 8.1 The three-stage memory model This model is a useful framework for thinking about the three basic memory stages. Each stage differs in purpose, duration, and capacity.

At this juncture, let's address the difference between the terms *short-term memory* and *working memory*. These terms are often used interchangeably but do in fact refer to different mechanisms. Short-term memory was first postulated by Atkinson and Shiffrin (1968) as part of their multi-store model of memory. In the muti-store model, short-term memory was thought to be a storage location—somewhere that stimuli could be held for a brief period of time. However, Baddeley and Hitch (1974) later proposed an alternative model of short-term memory; they called this system *working memory* (Ungerleider & Courtney, 2016; Gathercole & Baddeley, 2014). Baddeley and Hitch viewed working memory as composed of a number of related processes with different systems responsible for processing the different kinds of information an individual is consciously working on, keeping it available for immediate access (Ungerleider & Courtney, 2016). Baddeley and Hitch initially identified three systems/subsystems within working memory. The *central executive* is the supervisory system that monitors and coordinates the entire working memory system by allocating attentional resources and selectively prioritizing information as it relates to two subsystems: the *phonological loop* and the *visuospatial sketchpad*. The *phonological loop* processes spoken and written information; it is frequently likened to a "little voice" that continually repeats what needs to be remembered, keeping that

information active in memory. The *visuospatial sketchpad* keeps track of images and spatial locations needed for navigation purposes, and is frequently referred to as the *inner eye* (Camos & Barrouillet, 2014; Gathercole & Baddeley, 2014; Logie, 2014). In 2000 Baddeley added a third subsystem, the *episodic buffer*, that serves to link together information from the other parts of working memory and also creates links to time and order as well as to long-term memory. Therefore, working memory is an entire theoretical framework composed of hierarchical processes used to temporarily store and manipulate information in short-term storage. So, in many ways, working memory *is* short-term memory, but is composed of a number of sub-systems, rather than a unitary model as first proposed by Atkinson and Shiffrin. An example of a common experience for students that relies on working memory occurs when you are trying to take notes during a lecture and you fall behind. As you scramble to catch up, you are trying to record what has already been said while listening to what is currently being said.

The exact role of attention in short memory is unclear, but there is a relationship between the two (Pilling & Barrett, 2016; Tas, Luck, Hollingworth, 2016; Kuo, Stokes, Murray, & Nobre,2014). Attention involves the ability to selectively process, or enhance, specific information for further processing, while simultaneously ignoring, or inhibiting, other information. That is, attention allows us to "tune in" to some information (such as listening to a lecture or focusing on material to be studied) and to "tune out" other information (such as ignoring Facebook posts or classmates whispering). Although the topic of attention will be explored further in Chapter 9, we do know that the role of attention is important during encoding and manipulation of information in working memory (Pilling & Barrett, 2016; Murray et al., 2013).

Research suggests that attentional control plays an important role in memory. To maintain attention on a specific task, one needs to have a goal. Baddeley & Hitch (1974) hypothesized a *central executive* function as a way of maintaining attention. Although executive function refers more directly to processing information as it relates to goal-directed behaviour, there is clear overlap between working memory and executive function (Allen, Baddeley, & Hitch, 2014; Nee et al., 2013). Data reported by McCabe and colleagues (2010) link specific physiological structures to particular memory functions. Their results suggest commonality of function in working memory and executive function. They argue that the two systems are controlled by an *executive attention* component that is responsible for overseeing the maintenance of goals and for controlling for interference while a person is engaged in complex cognitive tasks.

Eventually the information will drop out of working memory and will disappear, unless it is further passed on to our *long-term memory* system—the system that can retain a seemingly unlimited number of pieces of information for an indefinite period of time. Together these three stages of memory explain how we process information into and out of memory.

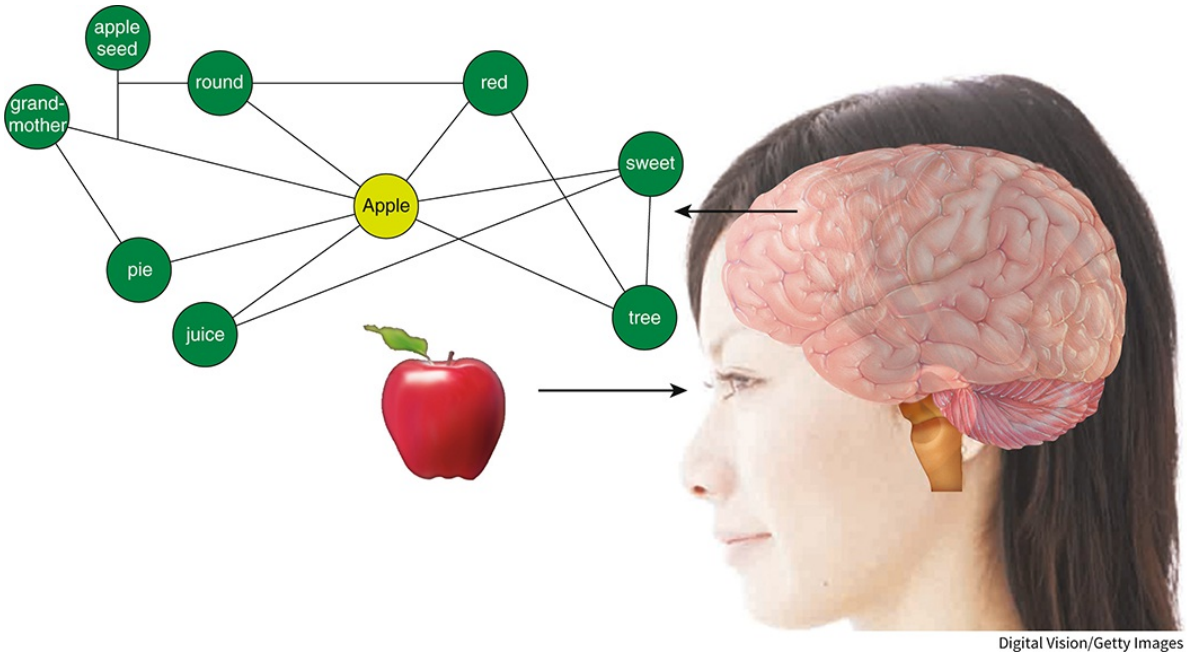
The three systems of memory proposed by the information-processing model are comparable to the operation of a computer. The small icons on our desktop are essentially small images that represent much more complex programs. *Sensory memory* works in a similar way, giving us a quick copy of the information in our environment. In addition, information saved to *working memory* is roughly equivalent to the information that a computer retains for as long as a document or website is open, but which disappears if you do not save it. And the final memory system, *long-term memory*, is the equivalent of the

computer hard drive, storing information until something causes disruption or loss of the memory. These three systems are sometimes referred to as *memory stores*. The information-processing model has generated a great deal of research that we will explore further in the sections of this chapter that focus on encoding, storage, retrieval, and forgetting. Consider for a moment what happens when you study. In order to eliminate competing stimuli (you set your phone to vibrate, close social media, and tell friends you need some quiet time), you sit in an area free of distraction and focus on your work. This behaviour allows sensory memory to eliminate non-specific stimuli so that working memory can process the information for the task at hand. As you process material, the information is gradually moved to long-term storage. We will discuss ways this can be done most effectively throughout the chapter.

Although the information-processing model suggests that sensory memory, working memory, and long-term memory correspond roughly to computer memory structures, we need to be clear that this is just a metaphor. If you break open a computer, you can find the dedicated modules where the various forms of memory are in operation. When we look at the human brain, however, there are no equivalent dedicated structures where short-term memory and long-term memory exist.

Unlike the information-processing model, which suggests that information is stored and retrieved piece by piece, an alternative model of memory, the **parallel distributed-processing model (PDP)** (or **connectionist model**), holds that newly-encountered pieces of information immediately join with other, previously-encountered pieces of relevant information to help form and grow networks of information (McClelland, 2011). Baddeley and Hitch used their working memory model to provide examples of parallel processing. They asked people to complete two tasks at once—one of the tasks was visual (using the visuospatial sketchpad watching for a visual target), and the other was sound-based (listening for a particular sound). They found that as long as the tasks were different (one visual and one auditory), people did about as well on each task as they did when they only did one of the tasks; they were able to do two things at once. However, when the tasks were the same (both visual or both auditory), people's performance suffered when they tried to do them together (Hurlstone, Hitch, & Baddeley, 2014; Conrad & Hull, 1964; Baddeley, 1966).

> **parallel distributed-processing (PDP)** (or **connectionist**) **model** theory of memory suggesting that information is represented in the brain as a pattern of activation across entire neural networks.



Digital Vision/Getty Images

FIGURE 8.2 The PDP model of memory **The PDP, or connectionist, model of memory suggests that memories are stored in a network of associations throughout our brains.**

These networks of information result in sophisticated memories, broad knowledge, and the ability to make better decisions and plans in life. Look, for example, at **Figure 8.2**. When the person in the figure sees an apple, connections to information involving things that are round, the colour red, or possibly grandma (because of the apple tree in her backyard) are all activated, while other, less relevant connections are inhibited. These connections are all part of the network of information related to apples that this person has stored.

When one part of the "apple" network is activated, related neurons throughout the brain also become active and richer memories spring forth. The PDP model of memory has gained many proponents, largely because its principles fit well with the field's growing recognition that neurons throughout our brains form networks of association as we respond to repeated learning experiences and events in life (Trippas & Handley, 2018).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

1. What are encoding, storage, and retrieval?

2. What are the three memory stores suggested by the information-processing model of memory?

What Do You Think? • Judging from your own experiences, do you think memory works more like a computer, with different memory stores, or more in a connectionist fashion? Could the two ideas both be useful in explaining some of your experiences?

How Do We Encode Information into Memory?

LEARNING OBJECTIVE 2

Describe how information is encoded and transferred among different memory stores and what we can do to enhance encoding.

How many steps are there from the front door of your building to your room? Can't remember? How about an easier question: what was the first word you said yesterday morning? Most of us probably cannot recall an answer to either of these questions.

Your lack of recall may be because the information was never *encoded*, or entered into your memory. Because we fail to encode many pieces of information that we come across in life, we do not actually remember most of the things that we experience. Encoding requires *attention*—that is, we need to focus on or notice the information in the first place. We can encode only what we attend to (Aly & Turk-Browne, 2016; Tas et al., 2016).

Using Automatic and Effortful Processing to Encode

We are not always aware that we are attending to things in our environment. Sometimes we attend to information—particularly information about *time, space*, or *frequency*—without much conscious awareness, and indeed with little or no effort. Even though you might not know how many steps there are from the front door of your building to the door of your room, you do not get lost along the way and you did not need to practise the route to figure out how to get to your room. The encoding process that allowed you to learn this basic route is called **automatic processing** (Milner & Rugg, 2013).

automatic processing encoding of information with little conscious awareness or effort.

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Effortful processing requires effort **Effortful processing, such as acquiring new information from a textbook, is easily disrupted when one also attends to other tasks during the encoding process.**

Although we use automatic processing to encode many kinds of information, the encoding of other information requires that we make conscious efforts and pay very close attention (Gilchrist & Cowan, 2010). This is the type of processing you are engaging in right now as you read this chapter, whether you are preparing for tomorrow's class or studying for a test. As you read through the material, you are trying to find ways to intentionally and consciously pay attention in order to process and understand this new information so it can be stored and maintained for later retrieval. This kind of encoding—which is typically needed when a person learns new information, such as new facts, names, or tasks—is called **effortful processing** (Rowland, 2014).

> **effortful processing** encoding of information through careful attention and conscious effort.

Keep in mind that whether you are encoding information through automatic or effortful

processing, you must be paying attention (see photo). Your attention might be less apparent in automatic processing, but if you do not attend sufficiently to information, in one way or another, you will simply not be able to encode it (Chow & Conway, 2015).

There are key differences between these two kinds of processing. First, the encoding of information by effortful processing tends to be disrupted when a person is forced to perform other tasks or to attend to other information while trying to encode the information at hand. You probably would not do very well on an intense video game if you tried to play it while carrying on a lively phone conversation, for example. In contrast, automatic processing, being so effortless, is disrupted only slightly by the performance of other tasks. For example, you would not likely spill coffee or tea if you were pouring it into your cup while talking on the phone because practice has made pouring an automatic processing task.

Second, as the name might suggest, putting extra effort into effortful processing makes it more effective. Automatic processing is not significantly enhanced by a person's extra efforts to attend and encode. You could rehearse the path from your front door to your room and count the steps, but it's unlikely that you'll know any more about the route than you knew this morning. In contrast, extra efforts can make an enormous difference in effortful processing. Merging your class notes with the information you read in this textbook will considerably affect your ability to recall the information later on a test.

Encoding Information into Working Memory: Transferring from Sensory Memory into Working Memory

As we observed earlier, when we first confront a stimulus, our brains retain a very brief sensory image of it—an image called a **sensory memory**. If, for example, we are shown a photograph for just a moment, we retain a detailed image of all the shapes and items in the photograph for a few hundred milliseconds (in an iconic store). Studies by researcher George Sperling in the late 1950s and early 1960s provided psychologists with important insights about how sensory memories operate (Sperling, 1960).

> **sensory memory** memory involving a detailed, brief sensory image or sound retained for a brief period of time.

Sperling wanted to demonstrate the presence of a brief visual storehouse—equivalent to the buffer memory of a computer—that would hold a picture of our environment for a very brief period of time. He also wanted to measure how long this buffer would last. To do so, he exposed participants to three rows of four random letters, similar to what you might see on an eye chart (although all letters were the same size; **Figure 8.3**). He presented those letters for less than a second and found that, generally speaking, participants did a pretty good job reporting the letters, most of the time remembering about half if asked to do so right away. In a second condition of the study, Sperling displayed the grid of letters for less than a second, and when the letters disappeared he played a tone that was either a low, medium, or high note. Participants only had to report the line of letters corresponding to the tone they heard, with the low note indicating the bottom row and the high note indicating the top row. If the tone sounded within about a half second of the grid disappearing, participants could usually report all the letters in the indicated row—it was

as if they just had to read them off their sensory or iconic store. If there was a delay of more than half a second between the visual list of letters and the tone sounding, people's recollection of the row of letters started to fall off, as they could no longer use their sensory memory. The longer Sperling waited to play the tone after showing the letters, the more performance declined.

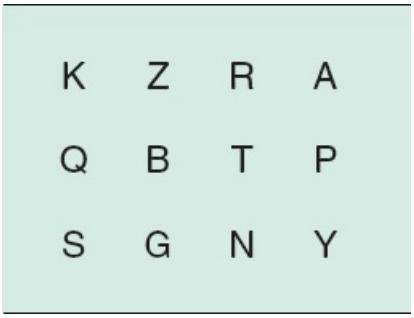


FIGURE 8.3 Test of sensory memory In his study of the duration of sensory memory, George Sperling flashed a chart of letters, similar to this one, for 1/20 of a second. He found that participants could recall almost all the letters in a particular row if asked to do so immediately, but half a second later, their performance declined.

If we do not focus our attention on our sensory memories, as is usually the case, they will disappear forever. Those that are attended to, however, may enter the **working memory**, the second system of memory. Working memory serves several important functions in our day-to-day lives (D'Esposito & Postle, 2015). One of the most important is that of enabling us to hold on to information—such as a phone number—that we need for short periods. Much of the time we use working memory in this way. Whenever we read, for example, our working memory enables us to keep the beginning of a sentence in mind while we are reading the last part of the sentence, so that the whole phrase will make sense to us (Unsworth, Fukuda, Awh, & Vogel, 2014; Wang & Gathercole, 2013). It also enables us to relate new sentences, such as this one, to previous sentences we have just read. Similarly, in a conversation, working memory helps us link new comments to previous ones so that we can follow what we are hearing.

working memory a short-term memory store that can hold five to nine items at once.

One way of helping to make sure that information is encoded into working memory is **rehearsal**, consciously repeating the information. As far back as 400 B.C.E., the ancient Greek philosophers recognized the value of rehearsal in memory. They advised students to repeat whatever they heard, on the assumption that hearing and saying the same things would transfer new information into memory (Spear, 2014; Clark, 2013). We are rehearsing when we keep repeating a phone number we have just heard until we can call it or add it to our phone's contact list. Such rehearsal increases the likelihood that the information will indeed enter our working memory and be available to us as we enter in the phone number. As we will see later in this chapter, although effective for short-term use, this form of *rote* rehearsal is less effective than more meaningful, or *elaborative*, forms of rehearsal (Flegal & Reuter-Lorenz, 2014; Mandler, 2014; Craik, Routh, & Broadbent,

1983).

> **rehearsal** conscious repetition of information in an attempt to make sure the information is encoded.

Encoding Information into Long-Term Memory: Transferring Working Memory into Long-Term Memory

Although concentrated efforts, such as rehearsal, can lengthen the availability of information in working memory, eventually that information is either passed on to the long-term memory system or lost (Zanto et al., 2016; Brady et al., 2013). It is in **long-term memory** that we hold all of the information we have gathered, available for use—often at a moment's notice—in a new situation or task. When we remember past events, previously-gathered information, people we once met, past feelings, or acquired skills, we are using our long-term memory system.

> **long-term memory** the memory system in which we hold all of the information we have previously gathered, available for retrieval and use in a new situation or task.

Just as rehearsal can help move information from the sensory memory system to the working memory system, it can also help move short-term, working memories into the long-term memory system (Nishiyama & Ukita, 2013). Most of us rehearse information from a course's textbook and lectures, for example, when we are studying for an examination. Information is more likely to pass into long-term memory when our rehearsal sessions are spread out over a period of time, rather than attempting to take in a great deal of information all at once. As we observed in Chapter 7 this phenomenon is known as the **spaced practice effect**. Thus, *distributed practice*, such as studying material weekly, followed by reviews closer to the time of an exam, is usually more profitable than *massed practice*, such as studying in one "cram" session just before the exam (Küpper-Tetzel, 2015; Rohrer, 2015).

> **spaced practice effect** facilitated encoding of material through rehearsal situations spread out over time.

As we also saw in Chapter 7, sleep can help or hurt rehearsal. Information acquired in the hours before falling asleep tends to be encoded into long-term memory, as long as we have time to process it before sleep sets in (Scullin & Bliwise, 2015; Genzel, Kroes, Dressler, & Battaglia, 2014; Rasch & Born, 2013). Information learned just as sleep is approaching is rarely retained, however, partly because we fall asleep before we can rehearse it. Furthermore, information that comes to us during sleep—a language tape, for example—does not typically enter our memories at all.

In What Form Is Information Encoded?

We must use some kind of code or representation to encode information into memory. Different codes are available to us (Gregg, 2014; Logie, 2014). When encoding information

into working memory—for example, trying to keep an address in mind before entering it into our GPS system—we can use a *phonological code*, repeating the sounds of the numbers again and again, or we can employ a *visual code*, holding an image of how the digits would look if written down (see photo). Research suggests that people tend to favour phonological codes (as if they were spoken) when recording verbal information, such as numbers, letters, and words. We rely more on visual codes for non-verbal information, such as a person's face or a speeding car (Miles & Minda, 2011).

Thinkstock/Getty Images

Putting working memory to good use **If you are trying to decide which cereal provides the best nutritional value, you need to keep a lot of information from the cereal boxes in mind as you decide which to buy.**

Although adequate for most purposes, the phonological or visual codes that people use to record information in their working memory tend to be flawed. For example, we sometimes confuse words or other items that sound or look similar to the items we are trying to hold in working memory (Saeki, Baddeley, Hitch, & Saito, 2013). Some people, however, produce visual images with extraordinary detail and near-perfect accuracy. Although recalling an object or scene that they have just witnessed, these people behave as if they are recalling items while looking at a photograph. Thus their detailed images are called *eidetic memories*, or photographic memories. Eidetic memories usually occur among children: as many as 5 percent of children encode images with this level of detail. The eidetic images can last for several minutes (Jaensch & Jaensch, 2013; Radvansky, 2015; Gregg, 2014).

When we encode *non-verbal information* into long-term memory, we once again tend to use phonological or visual codes (though other codes for things like smell are also likely at play) (Foster et al., 2017; Cortis, Dent, Kennett, & Ward, 2015). Long after a concert, for example, audience members may remember its intensity by visualizing images of the stage and the lighting effects, re-experiencing the smells of the arena and the crowd, and calling to mind the sounds of the musical instruments, the performers' voices, and the crowd's cheers.

In contrast, to encode *verbal information* into long-term memory, we tend to use **semantic**

codes, representations based on the meaning of information (Thomas, Neely, & O'Connor, 2012). This means that we link the new things we learn to the things we have already memorized based on shared meaning. Hearing that a friend of yours was seen out with someone other than her boyfriend gets linked to existing thoughts we might have had about the friend's previous commitment to the relationship, or to knowledge we might have about her tendency to hang out with a sibling fitting the description of the person she was with.

> **semantic code** cognitive representation of information or an event based on the meaning of the information.

Because we often rely on the meaning of information when transferring items into long-term memory, our later recall of events may be flawed to some degree (Rose, Myerson, Roediger III, & Hale, 2010). If you are listening carefully to a lecture focusing on a particularly difficult concept, you may not be able to say much later on about the facial expression or the tone of voice of the lecturer, as those bits of information are not stored semantically.

It is worth noting that the various codes may operate simultaneously when information is being encoded (Gregg, 2014; Logie, 2014; Morey, Guerard, Tremblay, 2013). One of these codes—semantic, phonological, or visual—may be used more actively than the others in particular instances, but when we use multiple codes, the combined impact of these codes increases the likelihood and strength of the memory (see Psychology Around Us 8.1).

Meaning and Encoding

Inasmuch as meaning often plays a key role in long-term memory, we should not be surprised that the more meaningful information is, the more readily it is encoded and later remembered. In a classic study, for example, people were asked to memorize 200 words of poetry, 200 nonsense syllables, and a 200-word prose passage. The poetry took 10 minutes to learn and the prose less than 20 minutes, but the nonsense syllables took an hour and a half (Larsen, 1986)!

8.1 Psychology Around Us

Highly Superior and Severely Deficient Autobiographical Memory

What would it be like to have trouble *forgetting*? Jill Price can remember almost every detail from her past. She is one of fewer than 100 people in the world with a condition initially known as hyperthymestic syndrome (excessive remembering). Price has almost perfect episodic memory; she can retrieve the details of every day of her life starting when she was 14 years old, and many from before then, identifying real-world events that occurred on the same date and re-experiencing the emotions she felt originally. She automatically and uncontrollably experiences a constant bombardment of fragmented memories. In 2000, Price sought out the leading memory expert in the United States, James McGaugh, now retired and a fellow and founding director of the Center for the Neurobiology of Learning and Memory at the University of California, Irvine. McGaugh and his colleagues studied Price, exposing her to a series of

comprehensive neuropsychological tests and batteries of exams. The researchers concluded that her episodic memory was virtually perfect (McGaugh & LePort, 2014; McGaugh, 2013). They also discovered that Price's performance on other types of standard memory tests, unrelated to her day-to-day life, was no different than that of age- and sex-matched controls. After publishing some of the results from Price's case study, referring to her as "AJ," McGaugh and his team were approached by others with this condition, and they have since identified a group of fewer than 100 people with what they have termed *highly superior autobiographical memory* (HSAM) (McGaugh, 2017; LePort et al., 2012). Researchers at the Center for the Neurobiology of Learning and Memory are currently examining HSAM in children.

Depending on your point of view, HSAM could be either a blessing or a curse. Of course, it would be wonderful to be able to remember the positive things that have happened to you in vivid detail; but imagine remembering—in minute detail—every slight, insult, and hurtful, humiliating, and distasteful event in your life, and being made to re-experience the emotions of those events over and over. Imagine that every new experience brought forward a flood of recollections of every similar experience you had ever experienced. Sometimes forgetting can be a good thing.

On the other hand, forgetting details regarding most of the positive events from your past would be terrible. In 2015, researchers from Baycrest's Rotman Research Institute in Toronto described a condition with opposite characteristics to HSAM. These researchers identified this condition as *severely deficient autobiographical memory* (SDAM). SDAM is characterized by an inability to distinctly recall autobiographical information in individuals who otherwise perform normally on tests of cognitive functioning, such as attention, perception, working memory, and executive function (Palombo, Sheldon, & Levine, 2018). Since SDAM is defined by a deficient or absent ability, it is more difficult to assess than HSAM. However, to date, five individuals with this disorder have been identified, with three studied intensively at the Rotman Research Institute (Palombo et al., 2015).

Both HSAM and SDAM represent extremes of individual differences along a continuum of autobiographical memory. Both challenge what researchers know about memory and are therefore important areas for future research.

Dan Tuffs/Getty Images News/Getty Images

The burden of HSAM Jill Price can remember in sharp detail most days of her life from around the age of eight.

Similarly, the more meaningful a personal event, the more readily it is encoded and later remembered (see photo). The day your grandfather went to the hospital was recognized by everyone in the family as a significant point in the family's life. Thus, you as well as all of your relatives clearly remember the day of his trip to the hospital with a possible heart attack. A lesser event, such as a day at the circus or a trip to the mall, might not be encoded as readily (McGaugh, 2013).

Kevin Lam photographer, www.kevinlamphoto.com, courtesy Patty Ho.

The subway? Really? Because people tend to use semantic codes (codes based on meaning) for long-term memory, people viewing this couple's wedding pictures might wonder why they went to a subway station for a photo. However, for the couple themselves, a stop at the subway station where they first met was especially meaningful.

People can help ensure that less meaningful information proceeds into long-term memory by artificially *adding* meaning to it (Endress & Potter, 2014) or by elaborating on the meaning of the information. Such efforts are known as **mnemonic devices**, which are cognitive techniques that impose additional or intensified meaning on various pieces of information (Esposito, 2016). Many new music students, for example, come to appreciate that the five lines of printed music of the treble clef are called *E-G-B-D-F* by first tying those letters to the sentence "*E*very *G*ood *B*oy *D*oes *F*ine." The first letter of each word in the sentence is the same as one of the lines of printed music. By giving more meaning to the musical language, the sentence helps students to encode the information into their long-term memory.

mnemonic devices techniques used to enhance the meaningfulness of information as a way of making them more memorable.

Throughout this chapter, we include relevant examples that we hope will make the information more applicable and more relevant and, in turn, make your memories more available when you need to retrieve this information. We will also provide you with tips for remembering. For example, one of the best ways to elaborate is by making the target information personally meaningful. For example, if you want to remember the difference between the spelling of the words dessert (a treat that follows a meal) and desert (a dry, hot, arid place), you might remember that dessert is "something extra" following a meal

and that “dessert” has an extra “s.”

Organization and Encoding

Another important variable that can enhance the encoding of information into long-term memory is *organization* (Norman, 2013). (See Practically Speaking 8.1.) Actually, when we add to or elaborate on the meaning of certain pieces of information or events, we are organizing them. That is, we are giving the information a structure that is more familiar and available to us. As such, we are making it easier to encode into long-term memory. Typically, we do this intuitively. If we asked you to memorize a list of words (and order of retrieval was unimportant) that included FOX, BEAR, ITALY, FRANCE, RABBIT, SPAIN, and MOUSE, you might naturally sort the words into rough categories of “Animals” and “European Countries.”

Thomas Imo / Alamy Stock Photo

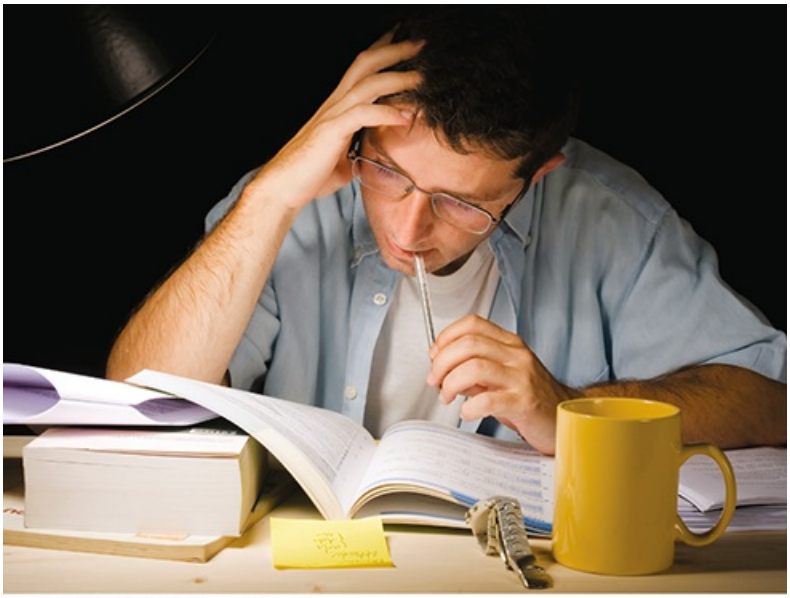
Schemas Being familiar with one university classroom can help us navigate a new one.

Organization by categories can be particularly useful in helping us to encode complicated situations. Cognitive psychologists have identified structures called **schemas**, knowledge bases that we develop based on prior exposure to similar experiences or other knowledge bases (Ghosh & Gilboa, 2014). Schemas can be helpful in allowing us to attend to and encode a lot of information in a hurry. Think about the first time you walked into a large university classroom. Did it feel awkward or strange because you weren’t sure of what was expected? You looked around to see where others were sitting, wondering if you could sit wherever you liked (see photo). You weren’t sure whether you could raise your hand and ask a question. If you had previously visited other universities, the schemas you developed during your experiences there probably helped you know what to do at your university.

schemas knowledge bases that we develop based on prior exposure to similar experiences or other knowledge bases.

8.1 Practically Speaking

Organizing Your Memories



Panther Media GmbH/Alamy Stock Photo

PQRST Method **This student is using the PQRST method as a step-by-step approach to studying that helps him learn strategically.**

As you know by now, organizing information is necessary for the proper storage and retrieval of memories. *Chunking* is one way of organizing information to help enhance memory (Xu, 2016). Let's imagine that you are coming home from a ski trip and just as you pull into the driveway you remember that your parents are away overnight *and* that they have a new house alarm. The battery on your phone is almost dead. You call your parents and they give you the number: 19980312. Before you can program this into your phone, it dies. You stay at your grandmother's house that night. However, had you known about chunking, you could have more easily remembered 1998 03 12, and you might have been able to sleep in your own bed. (Even better, make your chunks *meaningful*—for example, you might have noticed that your parents chose a code that embedded both your birthyear and the birthyears of your older and younger siblings: 1998, 2003 (03) and 2012 (12).)

Another organizational technique—*organizing a list* of unrelated words into a story—has also been shown to be very successful. In a classic study, participants who used this approach were able to recall, on average, over 90 percent of the words presented to them from 12 lists, compared to only 10 percent recalled by participants who did not use this approach (Bower & Clark, 1969).

A third way to organize new material is to create a *hierarchy* of the information, separating it into sections and subsections, much like the chapter of a textbook. For example, if you need to memorize the names of all the muscles of the body for an anatomy class, you might group them according to their locations or by their actions.

One very useful study technique for helping readers—such as yourself—to learn and remember textbook information is, once again, based on the principle of organization (Miqowati & Sulistyo, 2014). The *PQRST* method is an abbreviation named for its five steps, each of which are to be undertaken in order.

Preview Skim the entire section you are required to learn. Look for the basic themes and try to get a rough idea of the information you will have to process when reading the section in more detail.

Question Examine the organization of the section and turn each subsection into a question that you want to answer over the course of your reading.

Read Read the section with the goal of finding the answers to your questions.

Self-Recitation Ask yourself and answer aloud a set of questions that arose from the reading material. Work by Colin MacLeod at the University of Waterloo has shown that saying things out loud seems to increase their distinctiveness and make it more likely that they will be remembered later (Forrin, Jonker, & MacLeod, 2014).

Test Test yourself by trying to recall as much of the learned information as you can.

By organizing your reading in this way—by asking yourself questions about the information at hand before, during, and after reading—you stand a better chance of retaining the information than if you were to spend your time simply reading through the section several times.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

3. How does increased attention affect automatic and effortful processing?

4. Why is it more effective to study all term long, rather than in one massive session right before a final exam?

5. Which type of coding would most people use to remember someone's face? Which type would most people use to remember a person's name?

What Do You Think? • The author Samuel Johnson wrote, "The true art of memory is the art of attention." Can you think of experiences from your own or others' lives that bring this statement to life?

How Do We Store Memories?

LEARNING OBJECTIVE 3

Describe how we organize and store information in working and long-term memory and how we can enhance our long-term memories.

As you have seen, after entering the working memory system, information remains there for only a short period of time, usually no more than 20 to 30 seconds, unless we repeat or rehearse the information (Lucidi et al., 2016; Gathercole & Baddeley, 2014). In contrast, when information moves on to the long-term memory system, it can remain there for hours or a lifetime (Winocur, Moscovitch, & Bontempi, 2010). The retention of information—whether brief or long—in either of these memory systems is called storage.

Storage in Working Memory

Information may enter working memory from two major sources. Sensory information is briefly stored and then lost or sent on to working memory. In addition, we can bring system information that previously has been encoded in the long-term memory system back into the working memory for use in a current situation or task. Research suggests that memory and related cognitive functions peak at approximately age 25 (Baddeley, 2012).

Dmitriy Shironosov/Getty Images

Mental math and working memory **Working memory helps us to do mental computations.**

During the time that information from either of these sources is residing in the working memory system, it can serve many important functions in our daily lives, from enabling us to read or carry on conversations, to helping us solve current problems (Hofmann, Friese, Schmeichel, & Baddeley, 2011). The information stored in working memory also helps us do mental computations, such as mathematical problems (Ma, Husain, & Bays, 2014). We could not, for example, add together the numbers 12 plus 13 if our working memory were

not reminding us that we are computing those particular numbers, that addition is the task at hand, and that 3 plus 2 equals 5 and 10 plus 10 equals 20. In fact, because working memory helps us do mental computations, it is often characterized as a *temporary scratchpad* that briefly retains intermediate information while we think and solve larger problems (Buchsbaum & D'Esposito, 2013). (See photo.)

The Storage Limits of Working Memory

Once information enters working memory, it can be stored for just a limited period of time (Vergauwe, Camos, & Barrouillet, 2014). Concentrated efforts, such as rehearsal, can lengthen the availability of information in working memory, but eventually it is either passed on to long-term memory system or lost (Nee et al., 2013).

Just as striking as the limited *duration* of working memory is its limited *capacity* (Hofmann et al., 2011). On average, only five to nine items can be stored there at a given moment. This number was first uncovered back in 1885 by German researcher Hermann Ebbinghaus (1850–1909), who pioneered memory research by studying his own memory. Ebbinghaus's findings were confirmed over 70 years later by psychologist George Miller (1956).

In a typical study of this phenomenon, researchers present people with a sequence of unrelated digits, letters, or words, and then ask them to restate the items in the correct order. Because the items are unrelated and presented rapidly, it is likely that this procedure is tapping into the storage capacity of working memory only, not into some related information that has been stored in long-term memory. In study after study, almost every adult can recall sequences that consist of five items, but very few can recall lists consisting of more than nine items. Each individual displays his own **memory span**—the maximum number of items that can be recalled in the correct order—but no memory span strays very far from seven. Because research shows that almost everyone has a working memory capacity in this range, Miller described it as the "magical number seven, plus or minus two." There has been some debate over the accuracy of Miller's assertion. However, it is now widely accepted that working memory has a capacity of three or four chunks (Portrat, Guida, Phénix, & Lemaire, 2016; Mathy & Feldman, 2012).

> **memory span** maximum number of items that can be recalled in the correct order.

Enhancing Working Memory

Actually, the storage capacity of working memory is not quite as limited as it may seem from the Ebbinghaus and Miller studies. Each of the seven or so items that working memory holds can consist of more than a single digit, letter, or word. An item can consist of a "chunk" of information. **Chunking** pieces of information together into larger units enables us to encode more information in our working memory system, and it also enables our working memory to store more information at a given moment (Portrat et al., 2016).

> **chunking** grouping bits of information together to enhance ability to hold that information in working memory.

Say you are presented with a string of 23 letters, *o-u-t-l-a-s-t-d-r-i-v-i-n-g-n-i-g-h-t-w-a-s-i*.

Because your working memory capacity is only 7 ± 2 items, you would, on the face of it, be unable to store this entire sequence of items. Assuming letter order is not important, you might recognize that these letters can be chunked into words—"out," "last," "driving," "night," "was," and "I"—and now your task changes. Instead, you need to store only six items (that is, six words) in working memory, rather than 23, and the task becomes manageable. In fact, these words can be re-ordered and then further chunked into one item: the sentence "Last night I was out driving." If you store the information in this way, you still have room in your working memory for several other items. Similarly, without realizing it, we may be taking advantage of chunking when we first try to master a song's lyrics. Rather than learn the song letter by letter or word by word, we may hold on to seven new lines at a time, repeating the lines again and again until we have them solidly memorized.

Our ability to chunk actually comes from our long-term memory system (Ungerleider & Courtney, 2016). Recall that information may enter working memory as either new information arriving from sensory memory or through retrieval from long-term memory. In chunking, we use our stored, long-term knowledge that certain letters spell certain words, or that words can be organized to form sentences, to guide us in chunking new information.

Storage in Long-Term Memory

Whereas the sensory memory and working memory systems deal only with a limited number of short-term memories, our long-term memory system retains a seemingly unlimited number of pieces of information for an indefinite period of time, extending from minutes to a lifetime (Light, 2016). Indeed, memory researcher Elizabeth Loftus estimates that our long-term memory system may hold as many as one quadrillion (one million billion) separate pieces of information (Loftus, 2017). This expansive capacity and duration is critical to our functioning, for it is in this vast memory store that we hold—ready for use—all of the information that we have ever gathered. When we remember previously-gathered knowledge, past events and people, or acquired skills, we are using our long-term memory system.

Several factors influence whether particular events are stored in long-term memory. As observed, we must first attend to new information in order to have any chance of it eventually winding up in this memory system. Furthermore, items that are attended to must be encoded and briefly stored in working memory, and then encoded into long-term memory, before they can be stored in this memory system (Brady et al., 2013). Any shortcomings in these attention and encoding activities may prevent the information from being stored in the long-term system (Estes, 2014b). Moreover, even after information is successfully stored in long-term memory, some of it may become inaccessible (Roediger & Butler, 2011). That is, some of the information that we have previously acquired cannot be *retrieved* from long-term memory (Brewer & Unsworth, 2012). (See photo.)

Jean Catuffe/Getty Images

Explicit versus implicit memories **Explicit memories include facts, but also include memories about the experiences we have had in our past. In contrast, the learned motor behaviours and perceptual information that enable Olympic gold medallists Tessa Virtue and Scott Moir to excel in Pyeongchang are implicit memories.**

The capacity for long-term memory storage, while enormous for most of us, varies greatly among people. The differences from person to person may be due to factors such as attention and the ability to move information from working memory to and from long-term memory (Unsworth, 2016).

What Types of Memories Do We Store in Long-Term Memory?

Various kinds of information are stored in long-term memory, as shown in **Figure 8.4**. We will describe many of them here and a few more in later parts of this chapter (in the section on priming, for example). It is possible that different types of memory have evolved over time as different ways of specializing our memory function to optimize survival (Nairne, 2010). Similarly, some species, like dogs, have a better memory for smell and others for sound as part of their adaptation to their particular living environments.

Explicit memories consist of the types of memories that you can consciously bring to mind, such as your mother's birthday, or the movie you watched last weekend, or the capital of Canada. But there are other types of memories that we are not consciously aware of, such as learned motor behaviours and perceptual information that help us to develop various skills and habits. These **implicit memories** are carried out without intentionality and involve something you cannot bring to conscious awareness. Examples might include typing on your computer's keyboard, tying your shoes, playing the piano, or remembering how to walk on stilts even though you have not tried this since you were a very young child (Lewandowsky, Dunn, & Kirsner, 2014).

explicit memory memory that a person can consciously bring to mind, such as your

middle name.

implicit memory memory that a person is not consciously aware of, such as learned motor behaviours, skills, and habits.

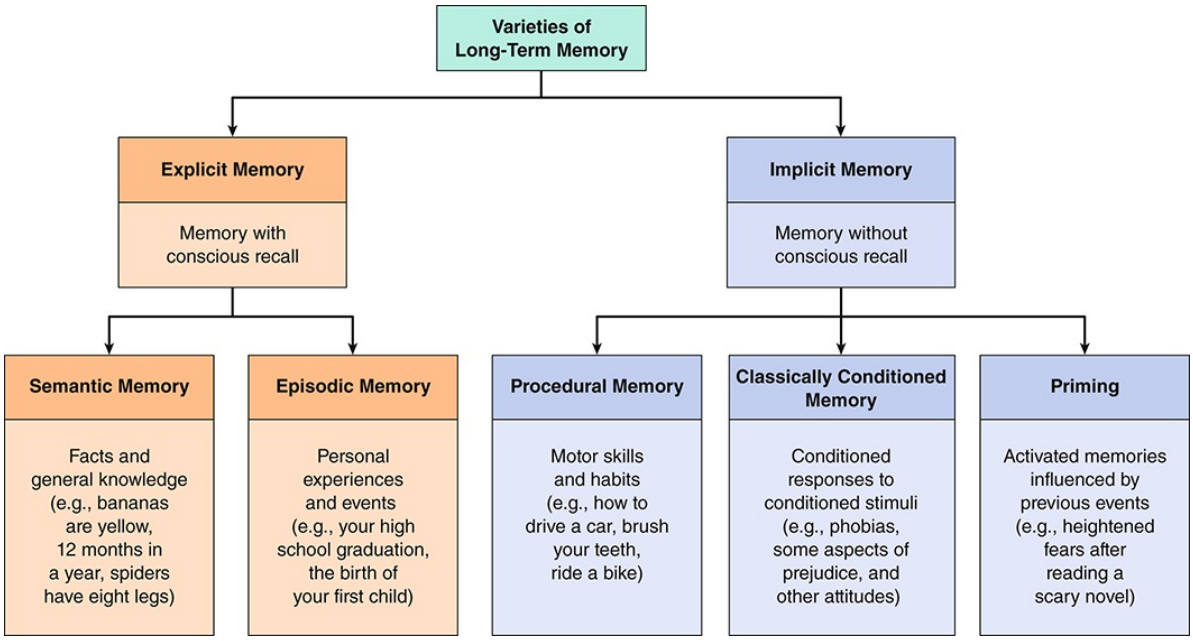


FIGURE 8.4 The long-term memories we store Our long-term memories are of two main types, with various subdivisions within each.

To make things even more complicated, there are two types of explicit memories. Endel Tulving, a well-known Canadian psychologist from the University of Toronto, first distinguished between semantic and episodic memory (Tulving, 1972). **Semantic memories** include our general knowledge of facts such as 2 plus 3 equals 5. **Episodic memories** are the knowledge of personal episodes from your own life, such as when you first learned to swim or ride a bike (see photo), or when a good friend moved away (Rugg & Vilberg, 2013; Roozendaal & McGaugh, 2011). Some studies further hint that these two subgroups of explicit memories may, themselves, be stored in different ways from one another (Renoult et al., 2016; Heisz et al., 2014).

semantic memory a person's memory of general knowledge of the world.

episodic memory a person's memory of personal events or episodes from his life.

KidStock/Getty Images

Semantic versus episodic memories **Semantic memories include general knowledge and facts, whereas episodic memories include personal episodes from our life, such as when we learned to ride a bicycle.**

Neuroimaging studies of patients with brain damage suggest that these two kinds of information are stored in different brain regions (Alberini & LeDoux, 2013; Mecklinger, Brunnemann, & Kipp, 2011). Explicit memories are converted into long-term memories in the hippocampus and then are stored permanently in various areas of the neocortex. In a sense, the hippocampus serves as a temporary storage site within the long-term explicit memory system (Buzsáki & Moser, 2013). In contrast, the striatum, the region located toward the midline in the brain, plays a key role in the storage of implicit memories (Goldfarb, Chun, & Phelps, 2016). As we observed in Chapter 7, when people need to call upon implicit memories to help them carry out various skills and habits, their striatum and its related structures become particularly active (Goldfarb, Chun, & Phelps, 2016; Bohbot et al., 2015). In fact, an individual whose striatum is damaged by injury or disease may have enormous difficulty performing longtime skills and habits such as driving, yet retain most of her explicit memories.

How Are Our Long-Term Memories Organized?

How does the long-term memory system organize the many pieces of information that are stored there? Is it set up like a bookstore in which the various items are organized first by broad categories, such as fiction and non-fiction, then by subcategories (in the case of non-fiction, for example, “art,” “health,” “nature,” “science,” or “travel”), and finally by sub-subcategories (for example, art books whose authors’ names begin with *A, B*, and so on)? Despite years of study, we do not fully understand how pieces of information are organized when stored in long-term memory (Abraham, Jones, & Glanzman, 2019).

At the same time, psychologists do now know that, regardless of their precise organization, the pieces of information stored in long-term memory are linked to each other, forming a network of interwoven associations. This web of associations enables us to travel rapidly through our long-term memory to retrieve much of the information we need for a current situation or task. As we saw earlier, the PDP, or connectionist, model of memory helps explain such networks by suggesting that our neurons also are activated in networks (McClelland, 2011).

There are other quite different ways to think about memory. One such alternative is Canadian researchers Fergus Craik and Robert Lockhart's (1972; Rose, Craik, & Buchsbaum, 2015) *Levels of Processing* model. This model suggests that rather than passing information through distinct types of memory (short- versus long-term), we process information to shallow or deeper depths.

Information can be superficially processed, such as the superficial attractiveness of a political candidate, or processed to greater depth, such as the stance the politician is taking on particular issues, or even further in terms of its symbolic significance, such as whether you see the politician as standing for "justice" or "equality" and so on. Information processed to greater depth is more likely to be recalled later. This means that when you are studying, you should read for understanding and for depth of understanding as this will ensure better recall of material on exams (Pomerantz, 2017).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

6. What is chunking, and why would you want to use it?

7. What kind of information is stored in semantic memory and episodic memory? Are semantic and episodic memories implicit or explicit memories?

What Do You Think? • What are some examples of elaboration and organizational strategies that have helped you in school or other areas of your life?

How Do We Retrieve Memories?

LEARNING OBJECTIVE 4

Describe how we retrieve information from memory and how retrieval cues, priming, context, and emotion can affect retrieval.

As we have noted, when information is successfully encoded from working memory into long-term memory, it is not only stored there, but is available for retrieval later. When we retrieve information from our long-term memory, it becomes available once again for use in our working memory system. Upon its return to working memory, the retrieved

information may be used to help clarify current issues, solve new problems, or simply re-experience past events (Unsworth et al., 2014; Baddeley, 2010). Retrieved memories of past NHL games and current knowledge about player performance may, for example, help us to pick teams in a playoff hockey pool. Similarly, retrieved memories of learned math timetables help us calculate new mathematical problems, and retrieved memories of how to manoeuvre our car help us when parking in a tight space. The kind or amount of information stored in long-term memory would mean little if we were unable to retrieve it. Like a library or the Internet, the information in long-term memory must be navigated efficiently and accurately to produce needed information.

The serial position effect demonstrates two basic retrieval effects (Ebbinghaus, 1913). To demonstrate the components of the effect, read a list of 12 words to a group of people. When you get to the end of the list, ask each person to write down as many words as they can recall. As you can see in **Figure 8.5** there are two types of serial position effect. First, participants remember more of the words from the top third of the list. This is called the *primacy effect*, and it reflects the fact that as they were listening to the words being read, participants were able to carry out more working memory work (e.g., repeating the words over and over) on the words at the top of the list before other words came along and replaced them in short-term memory. Because of this, those words were more likely to be transferred to long-term memory and were better recalled by all participants. Participants also remember more of the words from the last third of the list. This is called the *recency effect*, and this effect reflects the fact that items at the end of the list were still in working memory when the reading ended and that there was therefore less interference for the words at the end of the list.

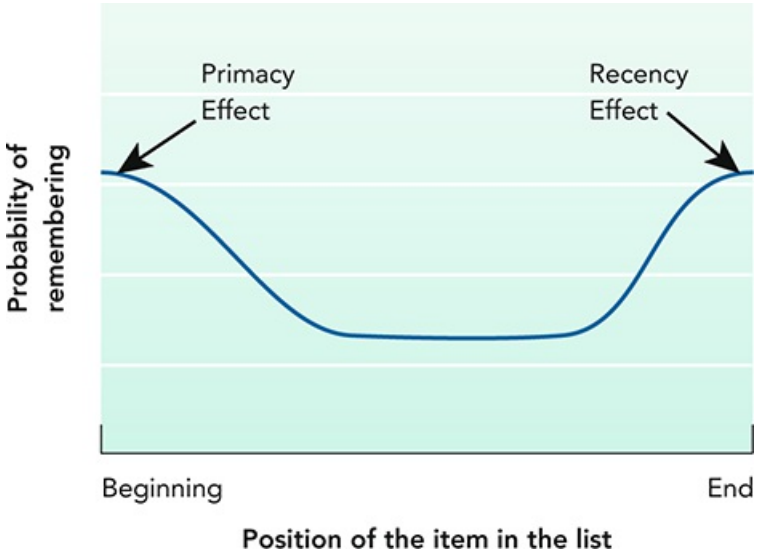


FIGURE 8.5 Serial position effect The results of a recall task plotted in the form of a curve yield this classic pattern. That is, the position of a word on a list influences how likely it is that the word will be remembered. Those words in the top third of the list (primacy effect) and the last third of the list (recency effect) are most likely to be recalled.

Source: Reprinted with permission of John Wiley & Sons, Inc., from Huffman, K. (2015). *Psychology in Action*, 11th edition. Hoboken, NJ: Wiley, p. 229.

Now redo the experiment with a different list and this time have half of the group immediately write down as many of the words as they can freely recall, while at the same time have the other half of the group count backwards from 1000 by threes. After 30 to 40 seconds, allow the counting half of the group to stop counting and ask them to write down as many words as they can remember. Again, all participants will demonstrate a primacy effect. However, this time there will be a difference between the two groups in terms of the recency effect. Those who got to recall words immediately will likely recall more of the words in the bottom third of the list than will those people who had to count backwards for a time following the end of the word list. The non-counters will do better because the words from the bottom of the list are still in short-term memory when the reading ends. Consequently they can, and usually do, write those words down right away, sensing that they might forget them if they wait. The counting group will recall fewer of the last words on the list as they had their working memory engaged in the counting task. By the time they got to start writing down words, the ones from the end of the list were not processed into long-term memory, had faded from short-term memory, and were no longer available for recall (Ebbinghaus, 1913).

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Recalling the past **Looking at old family photos with grandparents is a good way for her to retrieve information about family events from previous generations. The photos can serve as retrieval cues for accessing particular episodic memories.**

Just as researchers do not fully understand how information is organized when stored in long-term memory, they also do not know for sure how retrieval is carried out (see photo). Some theorists propose that retrieval relies on a kind of "search" process (Unsworth, Brewer, & Spillers, 2013). In other words, the person focuses on a specific question and scans her memory for the specific answer to that question. Other theorists believe that retrieval is more like an "activation" process in which the questions people pose to themselves activate relevant pieces of information that have been stored in long-term memory, after which this activation then spreads *simultaneously* to every other associated piece of information (Foster, Harrison, & Ruff, 2016; Lachman & Lachman, 2014). The difference between these two operations is akin to the difference between the results you

get to a specific question on a Wikipedia search versus the hundreds of sometimes quite diverse results you get from a Google search. Other researchers suggest that attention plays not only an important role in encoding, but is also important for retrieval (Lehman & Malmberg, 2013).

If we fail to locate a particular book in a library or bookstore, it can mean either that the book is not there or that we are looking for it in the wrong section. Similarly, our failure to locate a piece of information in our long-term memory may mean that it is not stored there (indicating either encoding failure or storage loss), or that we have committed a *retrieval failure* of some kind (Exton-McGuinness, Lee, & Reichelt, 2015; Rugg & Vilberg, 2013).

We experience many retrieval failures in our daily lives (Coane & Umanath, 2019). Often we find ourselves unable to recall a face, an event, or a scheduled appointment, yet it comes to mind later. Obviously the information was available in our memory all along, or we would not recall it later. Similarly, all of us have experienced the frustration of being unable to recall the answer to an exam question, only to remember it soon after the test. And in some instances we may become particularly frustrated when a piece of information feels like it is right at the edge of our consciousness, an experience called the *tip-of-the-tongue* phenomenon (Schwartz & Brown, 2014). In this situation, we feel like the information—the memory—we need is so close we can almost taste it. For example, when attempting to recall the name of a well-known Canadian actor, we might recall that he was nominated for an Academy Award for *La La Land*, that he was in the Mickey Mouse Club, that he was also in the movies *The Notebook* and *Crazy, Stupid, Love*, that he was born in London, Ontario, and that he has two daughters with Eva Mendes. We might even remember that his last name starts with a "G," but we cannot think of his *name* (Ryan Gosling)! Whether recall of the information we need is blocked by other information or was not originally learned quite as well as we might have wanted, we can often recover the information if we back up and think a bit about the context of the memory. For example, we often give up trying to remember and just as we begin to Google the answer, it comes to us. So, in an exam setting, think of the chapter, section, or lecture the information comes from, and then relax—that is often enough to get past the tip-of-the-tongue problem; sometimes the harder you try, the more the information you want eludes you (Miller et al., 2016).

The retrieval of information from memory is facilitated by **retrieval cues**—words, sights, or other stimuli that remind us of the information we need (what it related to or where we learned it originally, for example). Essentially, when we come across a retrieval cue, we enter our long-term memory system and activate a relevant piece of information. Because the pieces of information in this memory system are linked to each other in a network of associations, the activation of the first piece of information will trigger the activation of related pieces until a complete memory emerges (Reas, 2014).

> **retrieval cues** words, sights, or other stimuli that remind us of the information we need to retrieve from our memory.

Priming and Retrieval

If the pieces of information stored in long-term memory are indeed linked together in a network of associations, then the key to retrieving a specific memory is to locate one piece

of information and follow associated pieces until arriving at the memory. This activation of one piece of information, which then triggers the activation of other pieces and leads to the retrieval of a specific memory, is called **priming** (Henson et al., 2014; Was, 2010). Sometimes we consciously try to prime a memory. If, for example, we are having trouble remembering the name of an acquaintance whom we met last week, we may bring the letter *M* to mind, recalling vaguely that her name began with that letter and hoping that the *M* sound will lead to her name. Or we may try to recall our previous conversation with her, hoping that this recollection will eventually lead us back to her name.

> **priming** activation of one piece of information, which in turn leads to activation of another piece, and ultimately to the retrieval of a specific memory.

Priming may also take place without our conscious awareness. Say you are in a store and you vaguely notice the k.d. lang version of the late Leonard Cohen's song "Hallelujah" is playing on the store's sound system. If you were to walk out of the store and a friend were to ask you what song had just been playing on the store's speaker, you might not be able to recall it. However, if a short while later, in an unlikely turn of events, you find yourself in the *Cash Cab* (a TV show set in a real Toronto cab where the driver asks you questions and you can win money on your way to your destination; *Taxi Payant* in Quebec), and were asked to name three classic Canadian hit songs for $500, research suggests that you would be particularly likely to include "Hallelujah" in your answer. Although you had no choice in the matter and were not even aware that it was happening—and even if you dislike k.d. lang's voice or Leonard Cohen's music and were trying to ignore the song while in the store—it would have served as a retrieval cue and primed you to recall "Hallelujah" when later quizzed about classic Canadian hits.

Given the operation of priming, we should not be surprised that the more retrieval cues we encounter, or the more informative they are, the better our retrieval of memory. This is why people perform better on **recognition tasks**, ones in which they must report whether or not they have seen a particular item before, than on **recall tasks**, those in which they are forced to produce memories using no or few retrieval cues (**Figure 8.6**) (Wixted & Squire, 2010; Tulving, 1972). (See photo.)

> **recognition tasks** memory tasks in which people are asked to identify whether or not they have seen a particular item before.
>
> **recall tasks** memory tasks in which people are asked to produce information using no or few retrieval cues.

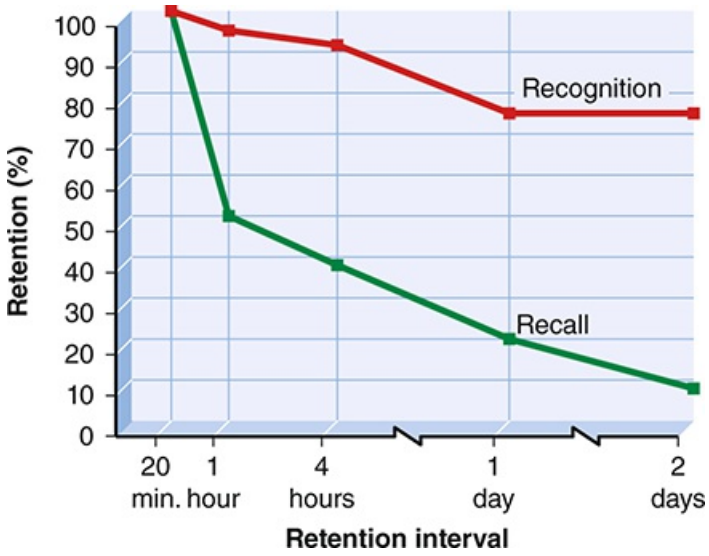


FIGURE 8.6 Recognition versus recall **In one study of retrieval, participants were tested for either recognition or recall of nonsense syllables over the course of two days. Retrieval on the recognition test was far superior than on the recall test.**

Source: Schwanenflugel et al., 1992; Luh, 1922

Context and Retrieval

It is often easier to retrieve particular information when we return to the setting or situation in which we first encoded it. Most of us have had personal experiences that attest to this. Upon returning to an old home or school, for example, we may find ourselves almost swamped by memories of events that we have not thought about for years. Similarly, a return to the scene of an argument or romantic encounter may evoke detailed memories of the original event. Not surprisingly, some educators believe that people perform best on exams when the exams are administered in the same rooms where the material was taught (D'Esposito & Postle, 2015).

THE CANADIAN PRESS/Nathan Denette

"Oh, yes, I remember them well" If asked to name several members of the Canadian men's 2018 Olympic hockey team (a recall task), even ardent hockey fans might have some difficulty. If, however, fans were shown this team photo (a recognition task), many fans would readily come up with such names as Mason Raymond, René Bourque, Rob Klinkhammer, Chris Lee, and Andrew Ebbett.

Clearly, returning to or duplicating the **context** in which information was learned may help us to retrieve it (Tulving, 2014). Why? Once again, the answer appears to be retrieval cues. Classic research by Canadian Endel Tulving provided evidence of these cues, resulting in the development of the **encoding specificity principle** (Tulving & Thomson, 1973). The encoding specificity principle is a theoretical framework that argues that the original context (location or situation), mood, or state in which we learn material is loaded with retrieval cues, each of which activates a piece of information, triggering the activation of associations and leading to memories of the original event. The likely impact of these many retrieval cues is an increase in the number, intensity, and accuracy of relevant memories.

context the original location where you first learned a concept or idea, rich with retrieval cues that will make it more likely you will be able to recall that information later if you are in that same location or context.

encoding specificity principle a theoretical framework that asserts that memory retrieval is more efficient when the information available at retrieval is similar to the information available at the time of encoding.

Specific Retrieval Cues

In 1975, Godden and Baddeley conducted what has become a classic experiment. They asked trained divers to memorize three lists of words on land or 20 feet (about 6 metres) underwater. Regardless of context for learning of the lists, participants then wrote down a list of 15 digits and then waited for minutes before being asked to retrieve the words they could recall. Twenty-four hours later, the participants were asked to once again recall the words—either in the same context they learned them or in a different context. The results indicated that lists learned underwater were best recalled underwater, and that lists learned on land were best retrieved on land. These results clearly demonstrate the role of context in learning: this is often referred to as the *context-effect*. You may have experienced something like this. You go downstairs to get an item, but once you get there you forget what you went to get. Frustrated, you go back upstairs—only to recall the item as soon as you are back in the familiar context. It is not always possible to return to the original site of our learning. In such cases, we can mentally revisit the context. If, in an exam, you are unable to remember something you learned in a class, try imagining the classroom to hear in your mind the professor's voice teaching you the information.

It has also been demonstrated that retrieving memories is most effective when in the same state of consciousness as when the memory was formed (Roediger & Craik, 2014). Alcohol-related **state-dependent memory** has been empirically shown to exist in humans. Anecdotally, it has been observed that alcoholics may hide money or bottles while drinking, but cannot recall the hiding place while sober. However, once intoxicated they easily recall where they hid the objects. Such anecdotal evidence has now been empirically demonstrated in the laboratory using lists. Here individuals are better able to recall words in the same state (that is, sober or intoxicated) as they learned them (Eich, 2014). This suggests that if you are drinking coffee while studying, you should ensure that you have an equal amount of caffeine in your system when writing the exam (see photo).

> **state-dependent memory** memory retrieval facilitated by being in the same state of mind in which you encoded the memory in the first place.

perfectlab/Shutterstock.com

State-dependent memory **Research indicates that individuals have better recall of information in the same state (e.g., sober or intoxicated) they were in when they learned them. This suggests, for example, that if you are drinking coffee while studying, you should ensure that you have the same amount of caffeine in your system when writing the exam, so that you would be better able to recall the information you studied while drinking coffee.**

Mood is also a powerful retrieval cue. In one study, participants learned a list of words while they were in a hypnotically-induced happy state of mind. Participants were found to remember the words better if they were tested later when in a happy mood rather than if they were in a sad mood (Bower & Cohen, 2014). Similarly, those who learned the words when in a sad mood recalled words better if they were tested later while sad, than if they were happy. Loeffler and colleagues (2013) assessed mood-congruent memory and arousal levels in daily life and reported that low levels of arousal enhanced the recall of words associated with positive recall, whereas high levels of arousal enhanced the recall of words associated with negative recall.

Other theorists further believe that a person's emotions may be more than just another retrieval cue (McGaugh, 2015). As we shall see in the following sections, they suggest that strong emotions may enhance memories by leading to increased *rehearsal, elaboration*, and *organization* of a particular event, or that intense emotions may trigger a *special memory mechanism*, producing emotional memories.

Emotional Memory: Rehearsal, Elaboration, and Organization

Research clearly shows that we remember emotionally arousing events better than neutral events (Christianson, 2014). If an event makes us particularly happy or distressed, we are better able to retrieve that information (McGaugh, 2015). However, the mechanisms by which emotions influence memory are not well understood. Deborah Talmi and her colleagues at the University of Toronto (Talmi, Lohnas, & Daw, 2019; Baraly, Hot, Davidson, & Talmi, 2017; Talmi et al., 2013; Talmi & McGarry, 2012) argue that it is important to distinguish between the direct and deferred effects of emotion on memory. According to

the *modulation hypothesis*, long-lasting emotional effects on memory can be attributed to the activation of the amygdala during the encoding of emotional events. However, this effect takes time, so it cannot account for the immediate effects of emotion on memory (Packard, Williams, Cahill, & McGaugh, 2013). Talmi and her colleagues suggest that the immediate effects of emotion on memory can be accounted for through the processes of attention, organization, and distinctiveness (Talmi et al., 2019, 2013; Baraly et al., 2017; Talmi & McGarry, 2012).

iStockphoto.com/Wavebreak

Emotional memory **We are likely to talk about a highly emotional event with friends or relatives. This response is a kind of repeated rehearsal, elaboration, and organization of the emotionally-charged event, and helps to improve the encoding, storage, and retrieval of the memory of the event.**

As well, over time, emotionally-laden events are more likely to be rehearsed (McGaugh, 2015). That is, we are likely to talk about highly emotional events with friends and relatives, perhaps write about them in a personal journal, or we may even try to revisit the scene or recreate the context of the event. Such behaviours are displayed by people who have achieved a special personal accomplishment, observers of exciting sporting events, or victims of accidents, hurricanes, or other catastrophes. Together, responses of this kind amount to repeated rehearsal, elaboration, and organization of the emotionally-charged events. Think back to your grandfather's trip to the hospital with chest pain. Talking about the anxiety and fear experienced that day with relatives not only helped you to recall the event, but probably also helped you to link it to other important events in the family. We have seen already that rehearsal, elaboration, and organization all are ways to improve the encoding and storage of memories; thus, we should not be surprised that exciting or upsetting events tend to be retrieved more readily than ordinary ones (see photo). (See Indigenous Experiences 8.1.)

Special Emotional Memory Mechanisms: Flashbulb Memories

If we were asked where we were at 9:00 a.m. on Tuesday, May 2, 2014, what we were doing, and who we were talking to, few of us would be able to answer off the top of our heads. Yet, if people old enough to remember were asked the same questions about their whereabouts on Tuesday, September 11, 2001, at 9:00 a.m., the fateful hour when planes crashed into and brought down the twin towers of the World Trade Center (and part of the Pentagon), many people could state with apparent accuracy and remarkable confidence these and other details (Hirst et al., 2015). Such detailed and powerful memories of emotionally significant events, or of the circumstances surrounding our learning of the events, are called **flashbulb memories**. Beyond widely-shared events, such as the 9/11 attacks, people also have flashbulb memories of emotional events that have more personal significance, such as the birth or death of a loved one.

> **flashbulb memories** detailed and near-permanent memories of an emotionally significant event, or of the circumstances surrounding the moment we learned about the event.

8.1 Indigenous Experiences

Better Understanding of the Past Through Oral History

Oral histories use subjective, personal accounts from speakers to enrich history by sharing unique memories of people, places, and past events. These accounts are not intended to be comprehensive, verifiable, or objective. Instead, they are personalized accounts of events and people that might otherwise be lost (Ritchie, 2011). Oral histories are usually collected from interviews, with those able to directly access memories of the past, or from those who have had recollections passed to them from others. Oral histories are believed to provide additional insights and details that can then be used to augment already-known facts. Oral histories therefore serve to formally preserve and strengthen memories of the past for current and future generations (Ritchie, 2011) and can also provide opportunities for healing and growth (James, 2020).

Shannon Freeman, from the University of Northern British Columbia, and colleagues (2020) carried out an intergenerational digital storytelling workshop aimed at bringing together Elders and children from the Nak'azdli Whut'en First Nations community in northern British Columbia. One of the Elders named the project "The Lha'hutit'en Project." In the Dakelh language, this means "we work together, we help one another" (Freeman et al., 2020, p. 286). Elders and youth worked together to preserve Elders' wisdom and knowledge. Elders shared stories and oral traditions with the children, who digitally recorded them. The children then added imagery and sounds, "creating a cultural legacy for future generations" (p. 284). One Elder noted how interested the children were in learning about their language. "It's really important to talk Carrier [the Dakelh language] to our children. It's a start. A lot of clans—they don't know the full language correctly" (p. 289).

The Indian Residential School Settlement Agreement exponentially increased the use of oral history narratives about Indigenous experiences with residential schooling. Rocky James (2020), from the Coast Salish Nation, at the University of British Columbia, observed many individuals as they participated in the independent assessment process (IAP). As one of the three avenues for truth and reconciliation, the IAP process was designed for residential school survivors to share their experiences of severe physical and emotional abuse at school with a staff member of the Department of Justice Canada. Remarking on the positive impact of sharing oral history, as experienced by those participating in the IAP process, James says, "Rather than living in the effects of someone else's actions, survivors were able to speak about someone else's actions, the effects those actions had on their life, and in doing so, restore their agency" (p. 342).

Source: Jeff Bassett

Elders share oral traditions Children benefit when Elders share stories and oral traditions with them.

The National Centre for Truth and Reconciliation houses these histories and many thousands of other statements and videos from survivors (see https://nctr.ca/archives-pages.php#statements) and will house an oral history collection as well. The importance of sharing their oral history for legal and public use validated survivors' experiences and helped with their healing (Truth and Reconciliation Commission of Canada, 2015). James cites William Westerman, an oral historian, as saying, "Testimony is about people rising from a condition of being victims, objects of history, and taking charge of their history, becoming subjects, actors in it. History no longer makes them; they make it, write it, speak it" (James, 2020, p. 342).

Critical Thinking Questions

What is an example of oral history from your own background?

What are two positive outcomes from the digital storytelling workshop? Do you think it was effective to involve children? Why or why not?

What do you think that Westerman (as cited by James, 2020) meant by saying that people "take charge" of their history when they share it? How is this idea related to James's notion of "agency?"

The kinds of details retained in flashbulb memories seem unavailable to us in our memories of other events (Hirst & Phelps, 2016). What is it about these special events that enable us to retrieve such details? According to some theorists, it is the extraordinary level of emotionality that we experience during the event. Specifically, our intense emotions may help trigger a special memory mechanism—a mechanism above and beyond the usual memory processes—that produces a near-permanent record and more likely retrieval of nearly everything we encountered during the event (Tinti, Schmidt, Testa, & Levine, 2014).

This proposed memory mechanism has yet to be fully identified, but certain studies do support the notion that emotionally-charged memories involve mechanisms beyond those operating for more neutral memories (Hermans et al., 2014; Tinti et al., 2014; LeDoux & Doyère, 2011). In a classic study, for example, some participants were given a tranquilizer drug while hearing an emotional story about a boy who received emergency surgery, whereas other participants were given a placebo drug during the same story (Cahill, Prins, Weber, & McGaugh, 1994). One week later, the participants who had been tranquilized—and due to the tranquilizer had experienced little emotionality during the intense story—remembered less about the story than did the placebo participants, whose emotions had been allowed to rise during the story. In contrast, when the study's participants were asked to recall a more neutral story, participants from both groups showed equal accuracy in their later recollections (**Figure 8.7**).

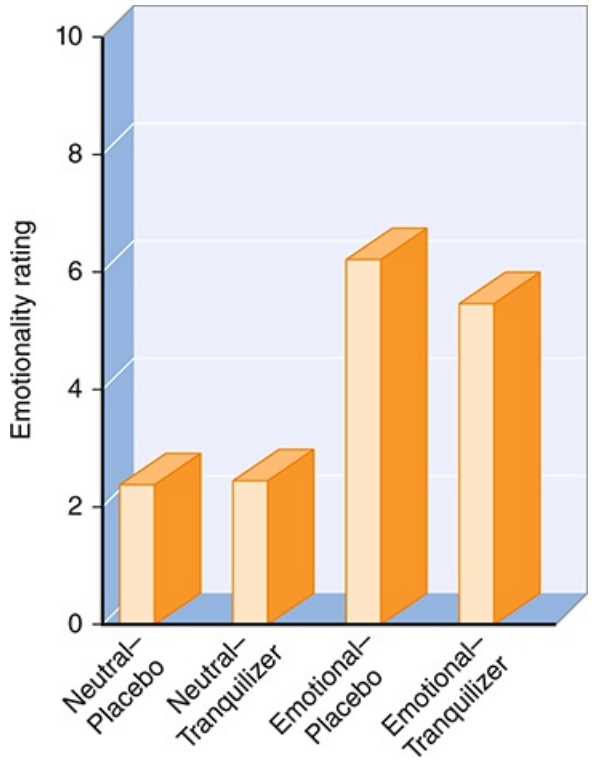


FIGURE 8.7 Emotional arousal and memory **In Cahill's study of emotion's role in memory, participants heard either an emotional or neutral story. Those given a tranquilizer while hearing the emotional story recalled less about the emotional story than those given the placebo. However, both groups recalled the same amount of information for the neutral story.**

Source: Adapted from Cahill, L., Prins, B., Weber, M., & McGaugh, J. L. (1994). Beta-adrenergic activation and memory for emotional events. *Nature*, 371(6499), 702–704, (Fig. 2).

On the other hand, more recent research has called into question whether flashbulb memories are, in fact, as highly accurate as they have been purported to be. Martin Day and Michael Ross (2014), both then at the University of Waterloo, conducted a survey where, immediately following the death of Michael Jackson, respondents were asked to report their attachment to Jackson as well as any flashbulb memories and emotional responses associated with first hearing about his death. Eighteen months later, respondents were asked again to report their flashbulb memories as well as their confidence in those memories. Results indicated that a stronger perceived attachment to Michael Jackson as well as an initial forecast of later accuracy in outcome predicted confidence in flashbulb memories but was not predictive of the consistency of their flashbulb memories.

Sometimes we might wish we could forget dramatic events because they cause us too much pain. Some exciting work by Karim Nader at McGill University suggests that this might be possible. In the past, we have assumed that our long-term memories are consolidated and thus hard to forget. Nader's work suggests that by recalling and speaking about a traumatic event, we may actually reactivate the memory storage process and must reconsolidate the memory to re-store it. Working with mice, Nader has found that an injection with a protein

synthesis inhibiter can actually remove the memory (Nader, Hardt, & Lanius, 2013; Schwabe, Nader, & Pruessner, 2013).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

8. If researchers show people several pictures of small rodents, then find that a lot of people include hamsters and mice when asked to name animals that make good pets, what has happened? Why did it happen?

9. Why do many educators believe it is helpful to take an exam in the same room where you learned the material?

10. How do strong emotions affect our memory processes?

What Do You Think? • Have you experienced flashbulb memories or state-dependent memory? If so, when?

Why Do We Forget and Misremember?

LEARNING OBJECTIVE 5

Summarize key theories of why we forget information and sometimes distort or manufacture memories.

Throughout most of this chapter, we have considered which variables help us to accurately remember events and information. But people do not always remember things as well as they would like (Tsukiura et al., 2011). The elusive name, the missed meeting, and the overlooked birthday of a friend or relative are all instances of **forgetting**—the inability to recall information that was previously encoded. Sometimes we not only forget information, we distort or manufacture memories. We recall events differently from the way in which they occurred, or we remember things that never occurred at all (Sadeh et al., 2014).

> **forgetting** the inability to recall information that was previously encoded into memory.

Theories of Forgetting

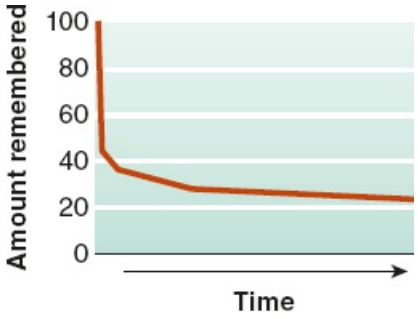
As we have observed, some apparent losses of memory are not really instances of forgetting at all, but rather are failures of attention. If our mind is elsewhere when we are putting down a set of keys or a remote control, we simply cannot encode such acts. Correspondingly, the location of such items will not be stored in memory and available for later retrieval. At the other end of the spectrum, some material is indeed stored and

available, but has weak or few retrieval cues attached to it, making it difficult for people to activate—or prime—the relevant memories in order to retrieve them from storage (Lewis, 2016; Warrington, 2014).

Beyond these common causes of forgetting, theorists have uncovered a number of variables that may actively interfere with memory and, in turn, produce forgetting (Spear, 2014; Macleod, Saunders, & Chalmers, 2010). Each of today's leading explanations of forgetting has received some research support, but as you will see, each also has key limitations and raises significant questions.

Decay

German researcher Herman Ebbinghaus pioneered the study of forgetting over a century ago by systematically testing his own memory of lists of nonsense syllables (for example, *lin, wek, sul*). After rehearsing and mastering a particular list, Ebbinghaus would measure how well he had retained the syllables after various intervals of time: 20 minutes, two days, a month, and so on. He found that there was a huge drop in his retention of a list soon after learning it. However, the amount that he forgot eventually levelled off; in fact, most of the information that had been retained 10 hours after first memorizing a list remained in his memory three weeks later. Known as the *forgetting curve* (see **Figure 8.8**), this pattern of rapid memory loss followed by a stable retention of the remaining information has been supported again and again by research (Murre & Dros, 2015; Erdelyi, 2010).



Source: Reprinted from Bahrick, Bahrick, and Wittlinger (1974).

FIGURE 8.8 The forgetting curve **We forget a great deal very rapidly, but the forgetting levels off and the amount of information we retain stabilizes.**

Many theorists explain patterns of forgetting, such as that observed by Ebbinghaus, by pointing to *decay*. According to the **decay theory**, memories often fade away on their own simply because they are neglected or not used for a long period of time (Hardt, Nader, & Nadel, 2013; Wixted, 2010). This theory is built on the notion that memories leave a physical trace in the brain—a so-called *memory trace*—when they are acquired. Theoretically, these traces fade away over time if the person does not use them.

> **decay theory** theory of forgetting, suggesting that memories fade over time due to neglect or failure to access over long periods of time.

Decay theory is a somewhat controversial theory of forgetting, although it still has

proponents (Hardt et al., 2013). It cannot account for the repeated finding that people learn seemingly forgotten information or skills much more rapidly the second time around than the first time. In other words, *relearning* is faster than initial learning. If forgotten information has, in fact, eroded because of disuse—that is, if memory traces have been lost—relearning should be occurring from scratch, and it should take just as long as the initial learning did (Michaelian, 2016).

Interference

According to the **interference theory**, forgetting is affected primarily by what happens to people before or after they learn information. This theory holds that information will be retained in memory as long as competing, similar information does not interfere with it (Uncapher, Thieu, & Wagner, 2016; Tillmann, Peretz, & Samson, 2011). Suppose your brother's long-term relationship ends and he starts a new relationship. Even though you like the new partner very much, you constantly find yourself referring to the new partner by the old partner's name. According to the interference theory, you forgot the new partner's name because competing information—the old partner's name—interfered with the retrieval of the new partner's name.

interference theory theory that forgetting is influenced by what happens to people before or after they take information in.

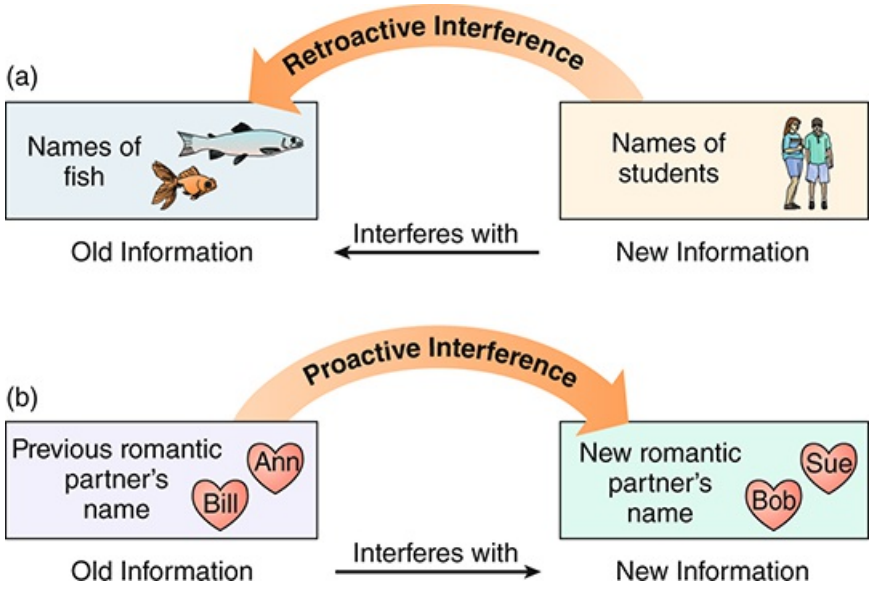


FIGURE 8.9 Retroactive and proactive interference **Forgetting is affected by interference from other information. (a) Retroactive (backward-acting) interference occurs when new information interferes with old information. For example, an ichthyology professor (fish specialist) may refuse to learn his students' names: "Every time I learn a student's name, I forget the name of a fish!" (b) Proactive (forward-acting) interference occurs when old information interferes with new information. For example, you may use an old romantic partner's name to refer to your new romantic partner.**

Source: Reprinted with permission of John Wiley & Sons, Inc., from Huffman, K. (2015). *Psychology in Action*, 11th edition. Hoboken, NJ: Wiley, p. 228.

When the competing information that prevents recall has been learned *before* the forgotten item, as in the case of the forgotten name, the process is called **proactive interference**. Alternatively, **retroactive interference** occurs when new information disrupts the retrieval of previously learned information (see **Figure 8.9**) (Jacoby, Wahlheim, & Kelley, 2015). Suppose, for example, that you need to set up a new password for computer access at work. However, shortly after setting up the new password you need to access old files from the server and the IT person asks you for your old password. You can't remember it. In this scenario, you forgot the old password because competing information—your new password—interfered with the retrieval of the old password.

proactive interference competing information that is learned before the forgotten material, preventing its subsequent recall.

retroactive interference learning of new information that disrupts access to previously recalled information.

We should keep in mind that old information does not always interfere with the learning or remembering of new information. Sometimes it can even help us learn and retain new information. For example, people who know how to roller skate often pick up ice skating faster than other people. Speakers of French may have an easier time learning to speak Spanish given their similar verb structures. Interference occurs only when old and new information *conflict* with one another.

We have observed how emotions—both positive and negative—often enhance memory by providing powerful retrieval cues, setting up additional rounds of rehearsal, or triggering special memory mechanisms. At the same time, most of us have had experiences in which negative emotions, such as anxiety, may help us to remember or may interfere with memory (see photos). (Hoshino & Tanno, 2016; Mogg & Bradley, 2016; Hawley, Grissom, & Dohanich, 2011).

Chip Somodevilla/Getty Images

Jeff Hutchens/Getty Images

Can you spell "anxiety"? Two children await their turn at the annual Scripps National Spelling Bee. Both are fully prepared, but their emotional states are another story. Who is likely to perform better?

Motivated Forgetting

Sometimes we forget information that is unpleasant, embarrassing, or painful (Aguirre et al., 2017; Fawcett, Lawrence, & Taylor, 2016; Mogg & Bradley, 2016; Hoshino & Tanno, 2016; Erdelyi, 2010). Suppose, for example, that during your first year at college or university, you completely bungle a conversation with a classmate on whom you have a crush. Humiliated, you give up all hopes of pursuing the relationship, and by the end of the semester, the two of you are hardly acknowledging each other. Fast-forward three years. By now, you have become much more suave, and, as it turns out, you and your former crush meet again at a graduation party. As the two of you laugh together, talk comfortably, and discover shared values, you wonder aloud how it is that you never got together during your four years at school. Taken aback by your comment, your new friend recalls for you the first-year bungling incident. You are shocked by this revelation. On reflection, you recall vaguely that a discussion took place three years ago, but for the life of you, you have no recollection of the stammering, falling, and other embarrassing moves you made. In fact, you do not even recall having been all that interested in this person in the first place.

Clearly, you have forgotten an incident and related information that was unpleasant. But why? One possibility is that because the event was so painful, you actively worked to forget it. You avoided opportunities for rehearsal, such as sharing the humiliating experience with friends or relatives or writing about it in your personal journal. You may have even avoided retrieval cues, such as the walkway where the embarrassing interaction occurred. In short, you avoided rehearsing, elaborating, or organizing the information, making it less available for later retrieval from memory. We also sometimes forget upcoming events that we find distasteful. For example, many people forget dental appointments (Pakpour et al., 2014). Why do you think that might be? (See photo.)

Thinkstock/Getty Images

Motivated forgetting **It does not take a lot of thought to figure out why people sometimes unconsciously forget their dental appointments.**

Of course, anyone who has *actively* tried to forget an upsetting event knows that this is not so easy to do. Even if we do not share the event with others, we often find ourselves

thinking about it (that is, privately rehearsing the event) again and again. Moreover, like a flashbulb memory, the emotional component of such an event often increases, rather than decreases, the likelihood of our remembering it.

Why then do we seem to forget certain unpleasant events or information? Sigmund Freud explained motivated forgetting through his theory of **repression**. Freud held that all people employ repression on occasion, a process in which we unconsciously prevent some traumatic events from entering our awareness so that we do not have to experience anxiety or blows to our self-concept that the memories would bring. According to Freud, the repressed material is not lost, but rather *hidden* from consciousness. He believed that our experiences, especially childhood experiences, are too powerful to slip away altogether. In fact, the hidden material may influence later decisions or interpretations of events, although we are not aware of its impact in such cases. It is important to recognize that research has produced mixed findings on whether people repress unpleasant events (Erdelyi & Goldberg, 2014; Patihis et al., 2014a, 2014b; Kihlström, 2006). In fact, as we address below, Elizabeth Loftus and others have argued that forgetting has nothing to do with repression (Garry & Hayne, 2013; George, 2013).

> **repression** process in which we unconsciously prevent some traumatic events from entering our awareness so that we do not have to experience the anxiety or blows to our self-concept that the memories would bring.

Distorted or Manufactured Memories

Our memories can be subject to distortions. In large part, this is because, as we observed earlier, we tend to rely on semantic codes when we encode information into long-term memory. That is, we encode the *meaning* of an event, rather than its specific words or images. In turn, when we later retrieve the memory, we have to *reconstruct* it. We must fill in details from our earlier recollection. Thus, when five persons later try to remember the same event—for example, when several family members recall your grandfather being taken to hospital with chest pain at a family gathering—each person may recall the details of the event quite differently.

A number of factors may contribute to faulty reconstructions of memory—that is, to the distortion or manufacture of memories. Three of the most common are *source misattributions, exposure to misinformation*, and the *effects of imagination* (see **Table 8.1**).

TABLE 8.1

Common Reasons Why We Distort or Manufacture Memories

Source misattributions	We often fail to record where the information came from when we encode and store the information in long-term memory
Exposure to misinformation	New information that is inaccurate or misleading can distort our recall or lead us to manufacture new memories
Effects of imagination	Our own imagination can lead us to recall events that never took place

Source Misattributions

When we encode and store information in long-term memory, we often fail to record where it came from originally. In a similar manner, we often forget or are confused about where we have gathered information that is now stored in our long-term memory system. Such **source misattributions** can render our memories of certain events distorted, or in some cases, manufactured (Loftus, 2017; Lindsay, 2014). Is your detailed recollection of getting lost at the mall when you were 4 years old a direct memory of that event? Or, are you actually remembering your parents' many stories about the event? Or are you confusing your own life with that of a cousin whose similar experience was often discussed in your family? We may have supreme confidence in our memory of the event and even "remember" vivid details about it, yet the memory may be inaccurate or even entirely false. We are remembering something, but it may not be the event itself.

> **source misattribution** remembering information, but not the source it came from; can lead to remembering information from unreliable sources as true.

Exposure to Misinformation

Earlier we noted that retroactive interference often causes us to forget something when we are later exposed to new competing information. Similarly, such exposure to new information, particularly misinformation, can also lead to the distortion or the manufacture of false memories (Newman & Garry, 2014; Morgan et al., 2013).

Consider a situation in which a man witnesses a mugging. If a week later the eyewitness is asked, "Could you please describe the mugger?," he is being called upon to rely exclusively on his memory for a description. If, however, the eyewitness is told in passing, as part of the questioning process, "We've had a number of similar muggings lately, involving a heavy, blond-haired guy with a beard," this new information may greatly influence the witness's recall of the mugger and the mugging incident. Such exposures to new information—often misinformation—are of great concern in police cases. Many a defendant has been accused or even convicted of a crime based on testimony from witnesses whose memories were unintentionally distorted or manufactured (Cochran et al., 2016; Resnick, 2014). (See Positive Psychology 8.1.) Mistaken eyewitness testimony is the primary cause of the conviction of innocent people (Wixted, Mickes, & Fisher, 2018). (See Your Brain and Behaviour 8.1.)

The impact of misinformation on memory has received considerable study in psychology laboratories. How do researchers "plant" misinformation in memory studies? A clever investigation by psychologist Elizabeth Loftus and her colleagues (1978) illustrates how this is done. Participants in her now classic study observed a film of a traffic accident and were then asked to remember certain details of the accident. One group of subjects was asked, "How fast were the cars going when they *smashed* into each other?" A second group was asked, "How fast were the cars going when they *hit* each other?" The experimenter's use of the word *smash* implies a very severe accident, whereas the word *hit* implies a milder accident. Not surprisingly, people who heard *smash* remembered the cars going at a faster speed than did those who heard *hit*. The researchers also asked, "Did you see any

broken glass?" Those who heard *smash* were much more likely to say yes than those who heard *hit*. In fact, there was no broken glass in the film.

Study after study has demonstrated the distorting effects of misinformation on memory. In each, participants first observe an event and later receive new, misleading information about the event from researchers (Pickrell, Bernstein, & Loftus, 2017; Thorley & Kumar, 2016; Ulatowska, Olszewska, & Hanson, 2016; Morgan et al., 2013). A short while after observing an uneventful interaction between two spouses, for example, participants in a study may be told, in passing, that one of the spouses is a rather hostile person, or amorous, or devious. Sure enough, in their later recollections of the observed interaction, many participants "remember" hostile, amorous, or devious acts by the spouse in question. Similarly, people have been induced, by subsequent exposures to misinformation, to "remember" objects—glasses, paintings, revolvers—that were not actually present in an observed event.

8.1 Psychology Around Us | Positive Psychology

Picking Cotton

Jennifer Thompson-Cannino was 22 years old when a man threatened her life at knifepoint and raped her. She was alone in her apartment at the time of the assault. She later identified Ronald Cotton as the perpetrator. Thompson-Cannino said that she deliberately studied the face and features of her assailant so that she could later identify him. Based on her identification as well as physical evidence from the crime scene, Cotton was convicted. Throughout his ordeal, Cotton maintained his innocence but was ultimately sentenced to life in prison plus 54 years. Eleven years later he was released from prison, having served time for a crime he did not commit. DNA evidence showed him to be innocent.

After several unsuccessful appeals, in 1995 Cotton's defence team obtained a semen sample from the police department and compared it with a semen sample found on the victim. The DNA did not match. The sample was then sent to a DNA database that showed a definite match to a convict, Bobby Poole, who had confessed to the crime to a fellow inmate. Cotton was pardoned.

It was later determined that the eyewitness identification procedures used by the police to convict Cotton were flawed. The lineup was based on the description provided. Thompson-Cannino identified Cotton first in a photographic lineup and later in a live lineup. In both instances she claimed she was 100 percent certain Cotton was her assailant. Cotton's identification and subsequent conviction is often used as an example of flawed eyewitness testimony because many components common to exonerations, including a confident eyewitness and insufficient physical evidence, were present in this case (Gronlund, Mickes, Wixted, & Clark, 2015; Wixted et al., 2015; Gronlund, Wixted, & Mickes, 2014). Cotton's is therefore an example of how eyewitness identification can lead to serious miscarriages of justice.

Thompson-Cannino and Cotton met years following his exoneration and have become close friends. They now travel together to speaking engagements to address issues related to wrongful convictions and judicial reform for eyewitness identification

procedures. They co-authored a best-selling memoir, *Picking Cotton: Our Memoir of Injustice and Redemption*, to tell their story of misidentification and wrongful conviction but also to share their tale of forgiveness and redemption, to share that everyone is capable of compassion, forgiveness, and change, regardless of circumstance (Thompson-Cannino, Cotton, & Torneo, 2009).

AP Images/Chuck Burton

An unlikely friendship Ronald Cotton and Jennifer Thompson-Cannino developed a friendship out of shared pain.

A particularly powerful way of being exposed to misinformation is through *hypnosis*. As we first saw in Chapter 6, people who are hypnotized enter a sleeplike state in which they become very suggestible. While in this state, they can be led to behave, perceive, and think in ways that would ordinarily seem impossible. They may, for example, become temporarily blind, deaf, or insensitive to pain. Hypnosis can also help people remember events that occurred and were forgotten years ago, a capability used by many psychotherapists. On the other hand, in recent years, it has come to the attention of researchers that hypnosis can also make people forget, distort, or manufacture memories by supplying misinformation (Dasse, Elkins, & Weaver, 2015; Erdelyi, 2010; Mazzoni, Heap, & Scoboria, 2010). Witnesses who are hypnotized to help them remember an observed crime are, in fact, likely to remember details offered or implied by the hypnotist. These details, such as the time of the crime, the clothes worn by the perpetrator, or the presence of a weapon, may be inconsistent with their actual observations. For this reason, police hypnotists must be extraordinarily careful when questioning witnesses. Other research suggests that some hypnotic techniques, such as focused mediation with eye-closure technique, continue to be useful in investigative interviewing (Wagstaff et al., 2011). Even so, in 2001, the Supreme Court of Canada ruled that eyewitness recollections that were gathered under hypnosis could no longer be admitted as evidence due to their lack of reliability and the risk of wrongful convictions (as cited by Roach, 2012).

The Effect of Imagination

It turns out that our memories can be distorted not only by misinformation supplied by others, but also by false information that comes from within, from our imaginations. Researchers have found repeatedly that when people are instructed to imagine the occurrence of certain events, many come to believe that they have in fact experienced the events (Patihis et al., 2013; Richardson, 2011).

In one study, a team of researchers asked the parents of university students to list events that had, in fact, occurred during the students' childhoods (Scoboria et al., 2017). In later interviews, the students themselves were instructed to recall those real events, along with another event that had not actually occurred according to the parents' reports. The students were not told that this event was false. A student might, for example, be instructed to recall the false event of accidentally knocking over a table at a wedding, as well as a number of events that actually had occurred. When interviewed some days later, about one-fourth of the students fully believed that the false events had occurred during their childhood, and, in fact, they could "remember" many details of the unfortunate experiences. Clearly, misinformation from others or from our own imaginations, or from a combination of the two, can greatly influence our recollections, leading at times to forgetting, distortions, or even the manufacture of memories (see photo).

AP Images/OSCAR SOSA

Hypnosis and memory **A police hypnotist uses the procedure to help a woman remember details of a crime that she witnessed. In fact, hypnosis often causes people to distort or manufacture memories, rather than rediscover them.**

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

11. How does the decay theory explain forgetting?

12. What is repression?

13. A late night TV show host suggests that supporters of one political party have more meaningful lives than members of the others. Although this person is obviously unqualified to know, your friends have started to tell you it's proven that members of this party make a difference, so they're thinking of switching parties. What might be happening to your friends' memories?

14. The saying, "Elementary, my dear Watson," did not appear in any of the writings of Sir Arthur Conan Doyle, the author of the Sherlock Holmes series, yet millions of fans vividly remember reading these words. What processes can explain this manufactured memory?

What Do You Think? • What examples of proactive and retroactive interference or memory distortions have you experienced in your own life?

Memory and the Brain

LEARNING OBJECTIVE 6

Describe how the brain is involved in memory.

Much of what we know about the biology of memory has come from studies of people who have suffered injuries to specific locations of the brain (Fornito, Zalesky, & Breakspear, 2015; Rabinowitz & Levin, 2014) and how specific (focal) injuries cause disruptions to networks of memories (Sharp, Scott, & Leech, 2014). (See Psychology Around Us 8.2 for a discussion on one way environment impacts shape the brain.) Important information has also been gained through experiments in which researchers surgically or chemically change the brains of animals and then observe the effects on old memories and new learning (Martinez & Kesner, 2014). In addition, over the past decade, studies using brain scans have enabled investigators to observe brain activity and structure at the very moment that people are thinking and remembering. Finally, molecular biology studies have shed light on specific changes that may occur in our brain cells as memories form (Kandel et al., 2014).

8.2 Psychology Around Us

Cannabis and Memory

Legalization of recreational cannabis in Canada has raised a number of important questions. The advantages of legalization include substantial increases in tax revenue, job creation, lower street crime, the freeing up of scarce police resources, and reduced disparities in drug enforcement, which disproportionately affect minorities and marginalized populations (McAleese, 2019). There are, however, problems with the potential increase in use that may have resulted from legalization. Of particular relevance to us here is that cannabis use is associated with acute (immediate) impairments in learning and memory, attention, and working memory, although the data is less clear regarding how long these neurophysiological impairments persist or whether they are permanent (National Academies of Sciences, Engineering, and

Medicine, 2017; Volkow et al., 2016). Tetrahydrocannabinol (THC) is fat soluble and therefore passes out of the blood quickly, with its metabolites remining in the brain and organs for prolonged periods. When compared with non-users, data show that intoxicated cannabis users perform significantly worse on tests of learning and memory, executive functions, attention, verbal abilities, and motor proficiencies. However, after a one-month abstinence, cannabis users show no discernable differences on these tests than non-users (Scott et al., 2018). However, other evidence suggests that a number of factors impact the extent of neuropsychological impairment following abstinence. These factors include frequency of use, duration of use, length of abstinence, and, critically, age of onset of use (Broyd et al., 2016; Schreiner & Dunn, 2012).

Mark Eisenberg at McGill University and his colleagues are particularly concerned about the effects of cannabis on prenatal development, on adolescent brain development, and on new users and psychologically vulnerable persons (Windle et al., 2019). In spite of mixed outcome data regarding use in pregnancy, cannabis is frequently used to treat pregnancy-related nausea and vomiting (O'Connor, 2018; Metz & Stickrath, 2015). THC readily crosses the placenta and is excreted in breast milk. Therefore, longitudinal work on the long-term impact of cannabis use in pregnancy is essential. Adolescents, too, are vulnerable because the brain is not fully developed until the early to mid-twenties. Given the immaturity of the brain, unsurprisingly, cannabis use during adolescence has been shown to disrupt normal brain development. Structural differences in brain areas associated with cannabis and comorbid alcohol use in adolescent users include the frontal and cerebellar regions as well as the temporal media regions (including the amygdala and hippocampus) (Batalla et al., 2014). Other studies indicate that early onset of cannabis use (prior to 15 years) leads to neuropsychological declines across a number of areas, including impaired short-term memory, decreased attention span, difficulties with problem solving, and decreased concentration; these impairments are not fully restored by termination of use (Meier et al., 2012). Therefore, additional evidence-based research focused on long-term implications and on harm reduction measures needs to inform public policy as we move forward in this newly legalized environment.

THOMAS SAMSON/Getty Images

Cannabis legalized **Research suggests that cannabis use in adolescence interferes with brain development.**

What Is the Anatomy of Memory?

Memories are difficult to locate. In the 1920s, neurological researcher Karl Lashley (1948) undertook a series of experiments with rats, in search of the specific places in the brain where memories are stored. He trained a group of rats to run through a maze, then cut out a different section of each rat's brain tissue and, following surgical recovery, set the rats loose in the maze again, checking to see whether they still remembered how to navigate through the maze. He found that all rats retained at least some memory of the maze, no matter what part of the brain he removed.

Based on studies such as this, researchers have concluded that there is no specific place—no storehouse—in the brain where memories reside (Dudai, 2011), and that information in the brain is encoded across various neurons throughout the brain. As we have seen, for example, connectionist theorists see memory as a *process* rather than a place, an activity that involves changes in networks of multiple neurons throughout the brain. This conclusion that there is no single place in the brain where memories reside is similar to the Chapter 7 conclusion that a single learning centre in the brain does not exist. Indeed, because memory and learning go hand in hand, you'll see that several of the brain structures and activities discussed in Chapter 7 to account for learning are also involved here as we examine the neuroscience of memory.

Although today's theorists believe that networks of neurons located throughout the brain are involved in memory, research has clarified that some brain areas are particularly important in the formation and retrieval of memories. Among the most important structures in working memory, for example, is the **prefrontal cortex**, a key structure within the neocortex (Sekeres, Moscovitch, & Winocur, 2017; Cholvin et al., 2016). When animals or humans acquire new information, the prefrontal cortex becomes more active (Squire & Wixted, 2016; Chein, Moore, & Conway, 2011), holding information temporarily and working with the information as long as it is needed. To refer back to our analogy between the brain and a computer, the neurons in the prefrontal cortex seem to operate like a computer's random access memory (RAM), drawing information from various parts of the brain and holding it temporarily for use in a task, yet able to switch whenever necessary to other information and tasks.

prefrontal cortex important brain structure located just behind the forehead and implicated in working memory.

Among the most important structures in long-term memory are the *hippocampus* (see **Figure 8.10**) and other parts of the neocortex (Monti et al., 2014; Tsukiura et al., 2011). In our earlier discussion of explicit memories, we noted that the hippocampus converts explicit memories into long-term status, stores the memories temporarily, and then sends them on to various areas of the neocortex for genuine long-term storage. Destruction of the hippocampus in adulthood does not wipe out long-term memories, only those that occurred just prior to the brain damage (Frankland, Köhler, & Josselyn, 2013; Jeneson et al.,

2010; Wixted & Squire, 2010). In contrast, destruction of certain parts of the neocortex results in the loss of older memories. These findings suggest that the hippocampus is indeed an important temporary storage site for long-term memories and a key player in the transfer of such memories into genuine long-term status in the neocortex. However, recent research from Morris Moscovitch, at the Rotman Research Institute at the University of Toronto, suggests that the hippocampus may also play an important role in retaining and retrieving autobiographical memories, as well as information about spatial layout (Moscovitch, 2014; Rosenbaum, Gilboa, & Moscovitch, 2014).

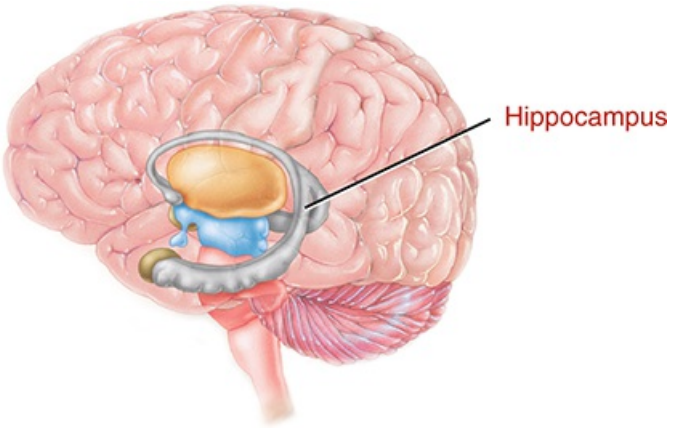


FIGURE 8.10 A key to memory **The hippocampus is a crucial structure for memory. It is activated when people recall information about facts and events.**

What Is the Biochemistry of Memory?

As we discussed earlier in this chapter, the PDP, or connectionist, model of memory describes the storage of information in long-term memory as a *network* of associations (McClelland, 2011). When we activate one piece of information, related ones spring into action, enabling us to travel rapidly through our long-term memory system and retrieve particular memories. But how, in fact, does the brain manage to link such pieces of information to each other? Research increasingly points to biochemical and electrical changes in certain neurons, particularly those neurons located in the key brain regions that we have just noted.

Neural Circuits

As we observed in Chapter 3, communication throughout the brain proceeds from neuron to neuron in a particular way. A given message arrives at a neuron as an impulse, travels down the axon of the neuron, and is then carried by a chemical—a *neurotransmitter*—across the synaptic space to another neuron. The next neuron is then triggered and, like the preceding neuron, passes along a message to yet another neuron, and so on. This stabilizing of a memory trace after initial acquisition is known as **memory consolidation**. As increasing numbers of signals are transmitted between neurons, groups (or networks) form and begin to respond to particular signals together. Initially these memory traces are fragile, but over time, they become more stable. That is, these groups of cells become increasingly likely to fire together in the future. This phenomenon of synchronous cell firing is called **potentiation**.

memory consolidation process by which memories stabilize in the brain.

potentiation synchronous networks of cells firing together.

The question for memory researchers is how such neural circuits form (Changeux, 2011). How is it that some neurons become predisposed to trigger other neurons, enabling us to retrieve a given memory? It appears that the repeated stimulation of certain networks of neurons greatly increases the likelihood that these groups of neurons will respond to future stimulation of the same kind, a phenomenon called **long-term potentiation (LTP)** (Nicoll & Roche, 2013). In this way, LTP affects not just single neurons but networks of neurons that make up neural circuits. The effects of LTP can last quite a long time (hence the name *long-term* potentiation), long enough to be a key factor in the formation and retrieval of memories (Nicoll, 2017). So, the ability to remember something is made possible by changes in networks of neurons. But memory traces are not static. That is, these networks do not exist in a fixed state but instead change with each new experience. This, as we discussed in Chapter 3, is the basis of *neural plasticity*. Think of many sleds ridden one after another down a snowy slope, creating a groove that later sledders can easily find. LTP seems to create a kind of pattern that helps memories form, so a person can more easily retrieve a memory later by following the well-worn path; however, we can (and do) create new paths as snowfall patterns change or sled designs differ and so on.

long-term potentiation (LTP) a phenomenon where repeated stimulation of certain nerve cells in the brain greatly increases the likelihood that the cells will respond strongly to future stimulation.

Researchers have gathered considerable evidence that LTP also plays a role in long-term memory (McGaugh, 2015; Nicoll & Roche, 2013). If experimental animals are given substances known to block the development of LTP, they have difficulty transferring information from their working memory into their long-term memory (Sekeres et al., 2017; Glaser et al., 2010). Conversely, drugs that enhance the development of LTP seem to improve the acquisition of long-term memories. In one study, for example, rats that were given an LTP-enhancing drug learned and remembered a water maze better than rats that were not administered the drug (Vallejo et al., 2014).

Many of the neurons and neural circuits that use *glutamate* as their neurotransmitter are particularly likely to exhibit LTP. This is not surprising because, as you may recall from Chapter 3, glutamate is a very common neurotransmitter, present in about 90 percent of all excitatory synapses (Danbolt et al., 2016). Glutamate is also a key neurotransmitter in the formation of memories. Moreover, neurons that exhibit LTP are commonly located in the hippocampus and neocortex—brain regions that play such important roles in the formation of long-term memories, as we have just observed (Nicoll, 2017; Glaser et al., 2010). In one study, researchers administered cocaine to rats and reported long-lasting LTP under circumstances that generally result in early forms of LTP, indicating that learning and memory processes could be modulated through environmental manipulation (Fole et al., 2013).

For some time, researchers have also been aware of the important role of *acetylcholine* in

learning and memory. Several important cholinergic (system related to acetylcholine) functions have been identified. First, acetylcholine probably plays a role in separating the encoding of new memories and the retrieval of existing memories so that each set of memories can be clearly segmented without interference (Smith, Villalba, & Galvan, 2016). Second, acetylcholine is important for controlling the sleep/wake cycle, which in turn is important for the consolidation, or stabilizing, of long-term memories (Schönauer & Gais, 2017; Dumay, 2016), particularly declarative memories (facts and knowledge that can be consciously recalled) (Cunningham & Payne, 2017; Micheau & Marighetto, 2011).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

15. Which parts of the brain are most active in memory? How are these parts related to neurotransmitters involved in memory?

16. What is a neural network and how might long-term potentiation contribute to its formation?

What Do You Think? • What side effects might occur if drugs were taken that could manipulate memory-related neurotransmitters and proteins? Should such drugs be legally available to anyone who wants them?

Memories in the Young and Old

LEARNING OBJECTIVE 7

Describe the kinds of memories and memory changes that characterize early life and later life.

Young babies can remember what certain objects look like (even if they don't know what they are), and can discriminate between a new object and a familiar one. Researchers assess this type of memory by measuring the amount of time a baby spends looking at an object. Babies prefer to look at, and so focus longer on, objects that they haven't seen before. This task, called preferential looking, is a useful way to study memory in babies who are too young to speak or to perform complex motor tasks that might otherwise reveal what they remember (see photo). Based on such research, we now know that the ability to remember novel objects increases from several minutes in very young infants to several days in toddlers.

As babies gain control over their movements, they become able to learn new skills—skills that also require memory, although a different kind of memory. Memories of skills form during the first year of life as well. For example, 1-year-olds can remember how to stack blocks or to successfully play with toys that require specific movements, such as winding a crank handle to get the jack in the box to pop up. Once learned—even in very early life—

this type of procedural knowledge is rarely forgotten. That is why, barring an accident, you will never forget how to tie your shoelaces or how to walk.

In short, babies and toddlers demonstrate memories—from memories of faces, places, and objects, to memories of skills and procedures. On the other hand, their specific memories of the *events* that occur in their lives are not very impressive. Prior to the age of 4 years, children do not hold onto memories of life events for very long. Correspondingly, most adults do not have any recollections of the events that occurred during their first 3½ to 4 years of life. This inability to remember events from the early years of life is often referred to as *infantile amnesia* (Madsen & Kim, 2016; White & Pillemer, 2014).

Why is it that young children can remember factual information, like the names of animals, from one day to the next, and remember how to play games and perform often complex motor skills, but they cannot form a permanent memory of life events? The answer to this question is that brain regions holding different types of memories do not develop at the same rate. That is, the brain circuits responsible for storing memories of events seem to develop more slowly than the brain regions responsible for storing information about language, motor skills, and simple associations (Callaghan, Li, & Richardson, 2014; Josselyn & Frankland, 2012).

As you learned in the previous section, in adults, memories about life events, often called *episodic memories*, are initially stored in the hippocampus (Moscovitch, Cabeza, Winocur, & Nadel, 2016). Only after temporary storage in the hippocampus is that information then distributed more widely throughout neocortical regions for long-term storage. We know that the hippocampus is a late-developing brain structure, and this late development might contribute to the inability to form episodic memories early on. Alternatively, it may not be a late-maturing hippocampus that is responsible for infantile amnesia, but rather the brain's early inability to transfer information out of the hippocampus to other locations in the neocortex (Rugg & Villberg, 2013).

Taweepat Larpparisut/123RF

"Hey, what's that thing?" After being placed in his crib, this baby immediately stares at (and continues staring at) the mobile above him. Why? It has been newly added to his stimulating environment—the only object he has never seen before. An infant's interest in something novel (new) in his or her environment is known as "preferential looking."

Of course, if you spend any time with talkative 2-year-olds, you will notice they have a lot to say about what has been happening in their lives. They may tell you what a friend said at nursery school, that a sibling took their toy, or that they are expecting their mom to come home from work later in the day. This shows that young children are in fact *forming* memories of life events, but that the information is not being stored permanently. If you ask those same 2-year-olds a few months later about the same life events, unless the events have been repeated over and over, the children will not recall them.

Think back to your earliest memory of a childhood event. If the memory is accurate (and not a manufactured one), it probably has an emotional component. The emotionally-charged event that you remember may be positive, such as receiving a special birthday present, going on an exciting vacation, or experiencing the arrival of your younger brother or sister (see photo). Or the remembered event may be negative, such as travelling to the emergency room after a fall off a scooter, being the victim of bullying in a preschool class, or experiencing the arrival of your younger sibling (note this event can be experienced positively or negatively). It is unlikely that the earliest event you remember is a neutral one, particularly if it occurred before the age of 4 years. The fact that most early life memories are emotional suggests that the episodic memory system is helped along at early stages by brain regions that process emotional information, particularly the amygdala (LeDoux & Doyère, 2011; Yonelinas & Ritchey, 2015).

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Emotions and early life memories **Most early life memories are emotion and may be positive or negative, such as the arrival of a new sibling.**

Having looked at memory during the earliest years of life, let's take a look at memory during the later years. As we travel through middle adulthood and old age, we become more susceptible to forgetting, distortions, and misremembering (Klaassen et al., 2012). Studies suggest that in the normal course of aging, elderly people are likely to experience declines in their working memories, their ability to encode new memories, their episodic memories, certain types of short-term memory, and the sources of information that they remember (Klencklen et al., 2017; Cherry et al., 2014). Researchers also have found that older adults tend to remember positive information while ignoring the negative (Maria & Juan, 2017; Reed, Chan, & Mikels, 2014), memories of aging people show little decline, several types of short-term memory remain strong throughout aging, and the semantic memories (general knowledge) of older people may actually improve (under normal conditions) (Park & Festini, 2017; Cohen et al., 2016; Rosenbaum, Winocur, Binns, & Moscovitch, 2015; Bäckman & Nyberg, 2010). Unfortunately, there's not much we can do to stop the decline in brain function, although research has shown that exercise is beneficial (see Positive Psychology 8.2).

8.2 Psychology Around Us | Positive Psychology

Slowing Cognitive Decline in Older Adults

Ridofranz/Getty Images

Preventing cognitive decline **There is no guaranteed way to prevent cognitive decline as you age; however, exercise increases blood flow to the brain and improves performance on cognitive tasks.**

It is important to recognize that typical cognitive aging is not a disease but is instead part of the normative aging process over adulthood. However, advancing age is associated with an increase in cardiovascular risk, which in turn affects cognitive function. Thus, methods that slow, prevent, or reverse cognitive decline can only benefit individuals and society.

Despite the many "brain games" promising to improve cognitive health (Millington, 2012) and false promises of cognitive improvement with cognitive training exercises (Sala & Gobet, 2019), there is no *guaranteed* way to prevent cognitive decline as you approach older adulthood (Naqvi et al., 2013). Evidence-based recommendations for preventing cognitive decline in healthy older adults have yet to be identified. However, some data presented in the *Canadian Journal of Psychiatry* (Dumas, 2017) suggests that healthy older adult brains are plastic enough to respond to strategies aimed at preventing, slowing, or reversing cognitive decline. Some medication-based strategies (e.g., hormone use) suggest benefits of estrogen on cognitive abilities. In addition, modifiable lifestyle changes, such as increasing exercise or eating a healthy diet, can positively impact cognitive change over time.

One modifiable lifestyle factor that is associated with increases in cognitive performance is physical exercise. Aerobic exercise increases blood flow to the brain, improves performance on cognitive tasks, and elevates mood (Barnes, 2015). Nader Fallah and colleagues (2013) at the University of British Columbia investigated ways in which exercise is associated with cognitive change in older adults by implementing resistance training with older adult women. Their results indicate that resistance training improved selective attention and conflict resolution.

Of course, exercise and improved cognitive functioning in adulthood is not limited to the elderly but is relevant for people of all ages (Ratey & Loehr, 2011). As well, studies in experimental animals have shown that physical exercise increases *neurogenesis*

(generation of new neurons) in the hippocampus and stimulates the health of neurons in general throughout brain structures that support cognitive functioning (Nokia et al., 2016; So et al., 2017). So, there's good scientific evidence to get up and get moving, and to keep moving!

An area of memory decline that is particularly upsetting for many older people is in the functioning of their **prospective memory**. A prospective memory involves remembering to perform a future intended action, as opposed to a **retrospective memory**, which involves the recall of past actions, events, or knowledge (Brandimonte, Einstein, & McDaniel, 2014). Prospective memories, or remembering to remember, help us to carry out our plans and effectively move through the day. They include, for example, remembering to pick up clothing at the cleaners, to call a family member, to send a birthday card, to take a prescribed medication at the right time, or to share a piece of information with a friend. Studies find that older people perform more poorly on prospective memory tasks than do younger adults, especially when the tasks become more demanding, distracting, or complex (Park & Festini, 2017; Gao et al., 2013). Declines in prospective memory can often be worked around by using strategies such as to-do lists or with training in specific strategies (Hering et al., 2014).

prospective memory ability to remember content in the future.

retrospective memory ability to remember content from the past.

Bloomberg/Getty Images

Brain fitness **A growing number of cognitive fitness centres are now being developed, where elderly people work on computer tasks designed to help improve their memories and cognitive functioning. However, research has not yet clarified that brain exercises prevent cognitive decline.**

Although the age-related changes in the way our memory functions are gradual, they actually begin in our twenties (Reuter-Lorenz, Festini, & Jantz, 2015). Certain parts of the brain, such as the hippocampus, begin to shrink. A study of the brains of elderly individuals found that the hippocampus was about 20 percent larger in those with excellent memories than those suffering from Alzheimer's disease, a finding that also may have implications for the memory losses that accompany normal aging (Stark & Stark, 2017).

As the elderly population continues to grow, an increasing amount of research is focusing on how to improve memory and prevent, or at the very least, lessen the impairments mentioned above. Fergus Craik, another very well-known Canadian researcher, now an emeritus professor at the Rotman Research Institute in Toronto, has shown that procedural and perceptual memory is not particularly affected by aging, while working memory and episodic memory decline substantially in the course of normal aging (Anderson & Craik, 2017; Craik & Salthouse, 2011).

Brain fitness approaches—using computer exercises and various mental games to keep the mind "in shape"—have become very popular and are often recommended to elderly patients by health-care professionals. Although this approach has received support in a few studies (Smith, 2016; Hughes et al., 2014), many of today's researchers remain skeptical about whether brain puzzles and the like can in fact prevent memory decline (see photo). On the other hand, research has demonstrated repeatedly and conclusively that *physical* exercise does indeed help to prevent or slow down deficiencies and impairments of memory and other forms of cognitive functioning (Müller, Chan, & Myers, 2017; Snigdha, de Rivera, Milgram, & Cotman, 2014; Hoveida et al., 2011).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

17. Why are toddlers able to effectively remember faces, places, objects, and certain skills, but are not able to remember the events of their lives very well?

18. Why do the memories of elderly people tend to decline and what techniques seem to help prevent or slow down memory problems?

What Do You Think? • Think of three of your earliest memories in life. Did the remembered events share certain characteristics, such as the arousal of great emotion or your age at the time?

Disorders of Memory

LEARNING OBJECTIVE 8

Describe physical and psychological disorders that disrupt memory.

At times, each of us has been inconvenienced by imperfect memories or by outright forgetting. When our memories fail to operate as we would like, we may experience dismay, frustration, or embarrassment. Imagine how upsetting and confusing life would be if memory failure were the rule rather than the exception, as it became for Lucy, the fictional character in the movie *50 First Dates*. Is this the experience of people who have memory disorders? To a large degree, the answer to that question is "yes" (Wilson & Fish, 2013).

There are two basic groups of memory disorders: *organic memory disorders*, in which physical causes of memory impairment can be identified, and *dissociative disorders*, in which the disruptions in memory lack a clear physical cause (Harris et al., 2016; Kihlstrom & Evans, 2014). We will discuss dissociative disorders in Chapter 15.

Organic Memory Disorders

Some changes in memory have clear organic causes, such as brain injuries or medical conditions. These injuries or conditions damage one or more of the brain regions or brain chemicals that are important in the formation, storage, or retrieval of memories (Harris et al., 2016). The most common kinds of organic memory disorders are *amnestic disorders*, which primarily affect memory, and *dementias*, which affect both memory and other cognitive functions (Aybek & Vuilleumier, 2017).

Amnestic Disorders

People with **amnestic disorders**, organic disorders in which memory loss is the primary symptom, experience retrograde amnesia, anterograde amnesia, or both (**Figure 8.11**). **Retrograde amnesia** is an inability to remember things that occurred before the organic disorder or event that triggered amnesia. **Anterograde amnesia** is an ongoing inability to form new memories after the onset of the disorder or event. Anterograde amnesia observed in amnestic disorders is often the result of damage to the brain's *temporal lobes* or *mammillary bodies*, areas that play a role in transferring information from working memory into long-term memory.

amnestic disorders organic disorders in which memory loss is the primary symptom.

retrograde amnesia inability to remember things that occurred before an organic event.

anterograde amnesia ongoing inability to form new memories after an amnesia-inducing event.

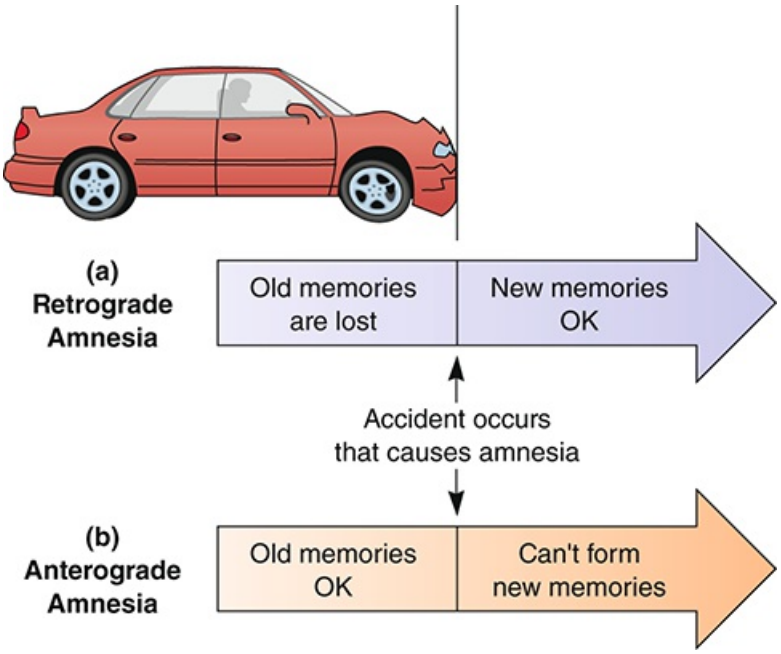


FIGURE 8.11 Two types of amnesia An organic event can lead to two types of inability to remember. In retrograde amnesia, the individual loses memories of things that occurred before the event. In anterograde amnesia, the individual can recall the past but cannot form new memories.

In severe forms of anterograde amnesia, such as that suffered by Lucy, the main character in the film and *50 First Dates*, new acquaintances are forgotten almost immediately and problems solved one day must be tackled again the next. The person may not remember anything that has happened since the physical problem first occurred. An older patient who suffered a physical trauma as a young adult more than 40 years ago, for example, may still believe that Pierre Trudeau, and not his son, Justin Trudeau, is the current Prime Minister of Canada.

Head injuries are a common cause of amnestic disorders. Although single instances of *mild* head injuries—for example, a mild concussion—rarely cause immediate permanent memory loss (Hayes et al., 2017), almost half of all *severe* head injuries do cause some permanent learning and memory problems (Berman et al., 2016). (See photo.)

However, even mild concussions can have serious long-term repercussions (see Chapter 3). Such findings are of particular concern given that many such injuries occur in childhood and adolescence. Carolyn Emery, from the University of Calgary, and her colleagues report that psychological and psychiatric problems in children diagnosed with repeated mild traumatic brain injuries (mTBI) were correlated with repetitive head injuries, hospitalization, and preexisting psychiatric diagnoses as compared with healthy controls or children or youth with injuries to areas other than the head (Emery et al., 2016). Brain surgery can also cause amnestic disorders. The most famous case of memory loss as a result of brain surgery is that of Henry Molaison (known for many years by his initials H.M.), a man whose identity was protected for decades until his death in 2008. Mr. Molaison suffered from severe epilepsy, a disorder that produced seizures in his temporal lobes. To reduce his symptoms, doctors performed bilateral (both sides) surgery in 1953

that removed parts of his temporal lobes, the amygdala, and the hippocampus. At that time, the role of these brain areas in the formation of memories was not known. (Today, temporal lobe surgery is usually done on only the right *or* left side of the brain.) Brenda Milner, one of Canada's best-known neuroscientists, spent many years studying the effects of the surgery on Mr. Molaison's memory. Mr. Molaison experienced severe anterograde amnesia from the time of his surgery until his death, though his procedural memory remained intact (Milner, Corkin, & Teuber, 1968; Scott & Milner, 1957). Mr. Molaison failed to recognize anyone he met immediately following the surgery and until he died.

Elsa/Getty Images

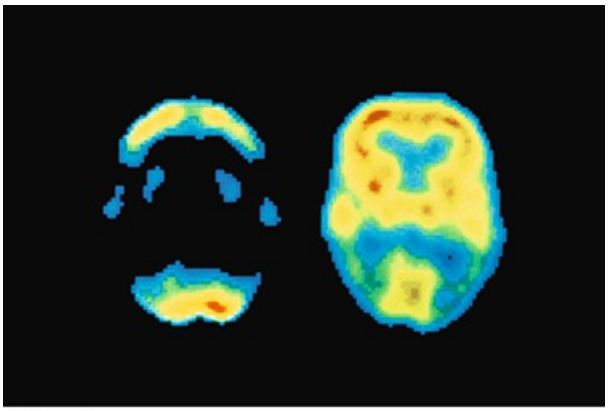
Part of the sport? As discussed in Chapter 3, hard hits to the head are common in boxing, football, and hockey, leading, in many cases, to concussions/mild traumatic brain injuries (mTBI) (Goswami et al., 2016). These may lead to chronic traumatic encephalopathy (CTE), a progressive, degenerative disease of the brain in individuals with a history of multiple brain injuries. As many as 350,000 athletes endure consciousness-losing injuries each year.

Dementias

As you have seen in this chapter, forgetfulness is quite normal. In fact, as people move through middle age, memory difficulties, lapses of attention, and related cognitive difficulties increase and may occur with some regularity by the age of 60 or 70. Sometimes, however, people experience memory and other cognitive changes that are far more extensive; they may be victims of dementia. In **dementia**, severe memory problems combine with losses in at least one other cognitive function, such as abstract thinking or language. Dementia is the most common type of neurodegenerative disorder. The American Psychiatric Association's Diagnostic and Statistical Manual, 5th edition (*DSM-5*) incorporates dementia in the broad diagnostic category of major neurocognitive disorder (NCD) (APA, 2013). To be diagnosed with NCD, an individual must demonstrate a significant decline in memory or another cognitive ability (e.g., language or learning) and this decline must impact and interfere with the person's day-to-day life. Mild

neurocognitive disorder (MND) is a category reserved for individuals who demonstrate moderate cognitive declines but who are still able to manage their own everyday activities.

dementia severe memory problems combined with losses in at least one other cognitive function, such as abstract thinking or language.



Science Source

Scans tell the story PET scans of the brains of a person with Alzheimer's disease (left) and a person without the disease (right), taken while the two individuals were performing the same task, reveal how much less brain activity occurs in the Alzheimer's patient. Red and yellow colours on PET scans indicate areas of high brain activity.

Worldwide, 50 million people suffer from dementia, with approximately 60% living in low to middle income countries. There are almost 10 million new cases a year (WHO, 2020). Its occurrence is closely related to age. Prince et al. (2013) report that worldwide prevalence rates for those 60 years old and over are 5–7 percent and that these rates are expected to double every 20 years, reaching a level of 152 million people with dementia by 2050. Current estimates suggest that there are 500,000 Canadians living with dementia in Canada with over 25,000 new cases of dementia in Canada every year (Chambers, Bancej, & McDowell, 2016). Dementia in Canada. Alzeheimer Society Canada. Toronto, ON.). (See Indigenous Experiences 8.2.) More than 70 forms of dementia have been identified. Although some forms of dementia result from metabolic, nutritional, or other problems that can be corrected, most forms are caused by neurological problems, which are currently irreversible.

Alzheimer's disease, named after Alois Alzheimer, the German physician who first identified the disease in 1907, is the most common form of dementia, accounting for as many as two-thirds of all cases (Wong, Gilmour, & Ramage-Morin, 2016). (See image.) This gradually progressive disease rarely appears in middle age, but most often occurs after the age of 65. The disease usually begins with mild memory problems, lapses of attention, and difficulties in language and communication. As symptoms worsen over the years, the person has trouble completing complicated tasks or remembering important appointments. Eventually, patients also have difficulty with simple tasks, distant memories are forgotten, and changes in personality often become very noticeable (see photo). They may withdraw from others, become more confused about time and place, wander, and

show very poor judgment. Patients may lose almost all knowledge of the past and fail to recognize the faces of even close relatives (Zahodne, Devanand, & Stern 2013).

Alzheimer's disease most common form of dementia, usually beginning with mild memory problems, lapses of attention, and problems in language, and progressing to difficulty with even simple tasks and recall of long-held memories.

8.1 Your Brain and Behaviour

Giving Eyewitness Testimony

Imagine you have witnessed a car accident where someone was injured. You called 911 and stayed at the scene to tell the police officer what happened. A few months later, you were called to testify as an eyewitness at the trial. How accurate do you think your memory would be?

When people give eyewitness testimony, many regions of their brains are involved, including the hippocampus, amygdala, prefrontal cortex, visual cortex, thalamus, and mammillary bodies, among others. Let's see how several of these regions are involved in such eyewitness testimony.

Peter Starman/Getty Images

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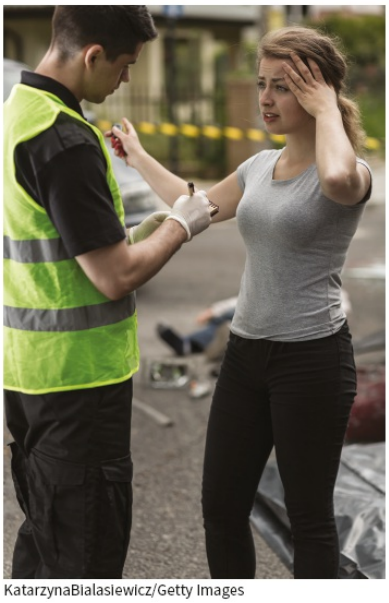
Image Bank Film: Signature/Getty Images

Image Source/Getty Images



KatarzynaBialasiewicz/Getty Images

Distorting the memory **Memories are often susceptible to distortions when they are recalled. Wrong information can be incorporated into an eyewitness's memory if leading questions are asked or if circumstances surrounding the inquiry are particularly frightening.**

Questions

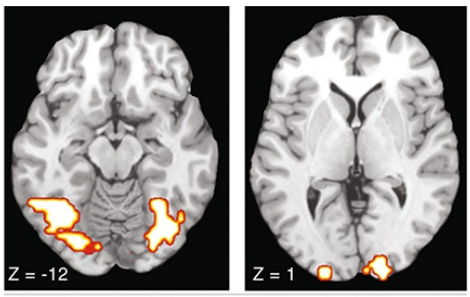
Imagine a person who has witnessed a bank robbery. Provide an example of a leading question that might alter this person's memory and a non-leading question that is more likely to preserve the original memory.

Explain how the visual cortex is activated differently when a person is remembering a witnessed event accurately versus inaccurately.

Discuss the role of the prefrontal cortex and the hippocampus in the storage and recall of eyewitness memory.

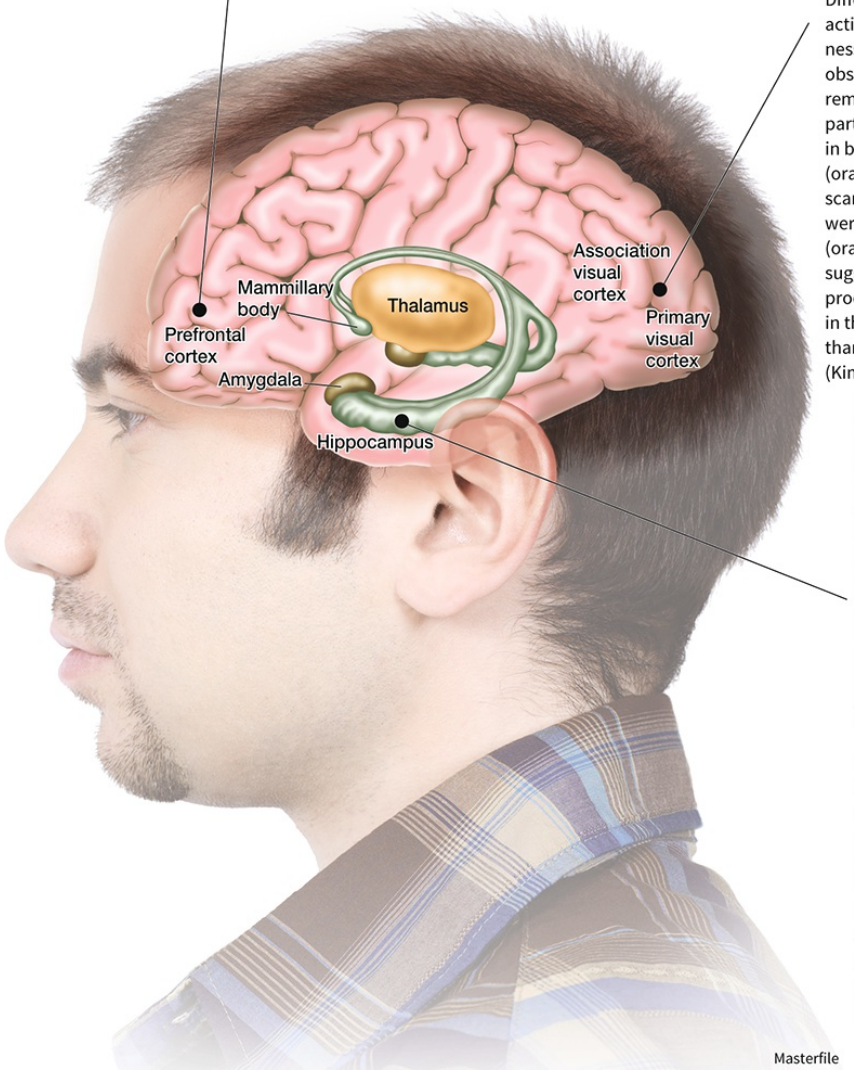
Courtesy Elizabeth Gould

Recalling the event Eyewitness retrieval and recall of the observed event depends largely on neuron activity in the cerebral cortex, shown here in this image of a florescent pyramidal neuron. In addition, protein synthesis in the pyramidal neurons of the prefrontal cortex enables memories to be stored again after they have been used.



Roberto Cabeza, Duke University. From Cabeza, Cerebral Cortex, 2007, Figure 4. Reproduced with permission of Oxford University Press.

Retrieving an incorrect memory Different parts of the visual cortex are activated when participant "eyewitnesses" accurately remember an observed event versus when they remember it inaccurately. Association parts of the visual cortex are at work in both true and false memories (orange areas on the left brain scan), whereas only true memories were active early in the visual stream (orange areas on the right). This suggests elaborative perceptual processing may be more involved in the formation of false memories than basic perceptual processing (Kim & Cabeza, 2007).



Masterfile

J. Livet, J.R. Sanes, J.W. Lichtman, Center for Brain Science, Harvard University

Storing the memory A major role in the formation and storage of memories about the observed event is played by the hippocampus, shown here in this image of neurons genetically engineered to make fluorescent dyes. The synapses in this brain region are changed by experience and are activated when we remember (Lichtman, Livet, & Sanes, 2008).

8.2 Indigenous Experiences

Addressing Dementia in Indigenous Communities

Dementia is an umbrella term for a variety of disorders with common features, such as

deterioration of memory and language, reduced learning capacity, problems with judgement and reasoning, and changes in mood and behaviour. These symptoms affect a person's daily living by interfering with work, relationships, and self-care. However, increased age, an irreversible factor, continues to be the single most significant factor that predicts dementia. Nevertheless, even though dementia affects primarily older people, it is not a normal part of aging.

There are approximately 1.4 million Indigenous people (including First Nations, Métis, and Inuit) in Canada (Statistics Canada, 2013) and of these, approximately 14–15 percent are expected to be over 65 by 2031 (Caron-Malenfant & Morency, 2011). There is little data on rates of dementia in Indigenous people. However, age-standardized data indicate that First Nations people are at a higher risk for dementia than non-Indigenous people, leading to an expected fourfold increase prevalence in dementia among First Nations populations by 2031 (versus a 2.3 fold increase among non-First Nations people during the same timeframe) (Walker & Jacklin, 2019).

Sharlene Webkamigad, from the School of Rural and Northern Health at Laurentian University, and her colleagues (2020) used a knowledge translation approach to develop culturally sensitive and evidence-based Indigenous-specific fact sheets about dementia. Specifically, they used the decolonized two-eyed seeing framework, which draws on Western knowledge and ways of knowing and Indigenous knowledge and ways of knowing and does not allow one view to dominate the other. The researchers worked collaboratively with Health Canada's First Nations and Inuit Home and Community Care program managers and frontline workers as well as community leaders and experts to create culturally relevant materials. They also conducted a thorough literature review and completed an environmental scan of existing resources.

In developing the fact sheets, Webkamigad et al. (2020) considered levels of literacy and language choice, choosing appropriate grade levels for readability as well as familiar words. For example, the researchers found that many Indigenous people viewed memory loss and confusion as a normal part of aging and therefore no word for "dementia" was found to exist in many Indigenous languages. However, the "Tahltan First Nations people in British Columbia say, 'Kadousah', which means 'not knowing if you're coming or going'; or 'Edu M'Diid Sugo ta a', which means 'not brain well'" (Webkamigad et al., 2020, p. 83). The researchers argue that more familiar terms, such as "forgetful," "thoughts mixed up," or "confused," should be used instead of more formal terms. Further, input from the project Elder, Jerry Otowadjiwan, an Indigenous knowledge keeper who was involved throughout the project, resulted in the discarding of egocentric terms used in existing resources, replacing person-centred language with terms more compatible with an understanding of peoplehood, which is a more collectivistic approach.

PeopleImages/Getty Images

Recognizing dementia **Culturally appropriate health materials will help increase Indigenous understanding of dementia.**

To recognize the diversity of Indigenous cultures, two versions of the final fact sheets were developed. One version was created to be modified for use with various Indigenous groups. The other version was a completed national version. The completed fact sheets can be found at https://www.i-caare.ca/factsheets.

Critical Thinking Questions

Why do you think that culturally sensitive and evidence-based Indigenous-specific fact sheets about dementia were needed?

What would be an example of language that is "person-centred?"

What would be an example of language that is more "collectivistic?"

People with Alzheimer's disease form far more numbers of *neurofibrillary tangles* and *senile plaques* than do those without the disease (Ando et al., 2014). **Neurofibrillary tangles** are twisted protein fibres found within the cells of the hippocampus and several other brain areas. **Senile plaques** are sphere-shaped deposits of a protein known as *beta-amyloid protein* that form in the spaces between cells in the hippocampus, cerebral cortex, and several other brain regions, as well as in some nearby blood vessels. Although these brain changes are normal features of aging up to a point, the presence of so many tangles and plaques indicates that enormously destructive processes are taking place in the brains of Alzheimer victims (Hasegawa, 2017; Harrison & Owen, 2016). (See photos.)

neurofibrillary tangles twisted protein fibres found within the cells of the hippocampus and certain other brain areas.

senile plaques sphere-shaped deposits of a protein known as beta-amyloid that form in the spaces between cells in the hippocampus, cerebral cortex, and certain other

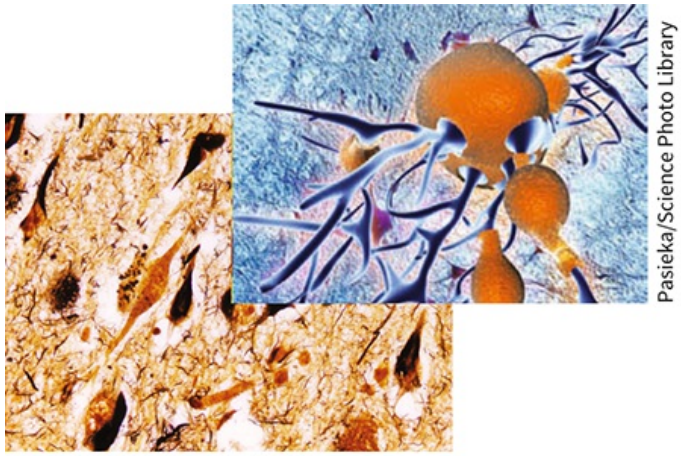
brain regions, as well as in some nearby blood vessels.

Yet another line of research points to reduced activity of neurotransmitters that are typically related to memory. Many studies have found, for example, that acetylcholine and glutamate are in low supply in the brains of people with Alzheimer's disease (Jha et al., 2016; Kandimalla & Reddy, 2017). This decrease is probably related to the death of neurons by plaque and tangle formations.

Agencja Fotograficzna Caro/Alamy Stock Photo

Progressive deterioration A staff member at a special residential facility helps a man with Alzheimer's disease shave. As memory deficits and other features of the disease worsen over the years, patients have trouble performing even simple tasks.

Alzheimer's disease can usually be diagnosed with certainty only after death, when structural changes in the person's brain can be fully identified in autopsy (Mitolo et al., 2016). However, researchers are working to identify other diagnostic approaches using various biomarker combinations (Tarawneh et al., 2016; Struyfs et al., 2014; Landenson et al., 2013).



UCSF/Image Source/Getty Images

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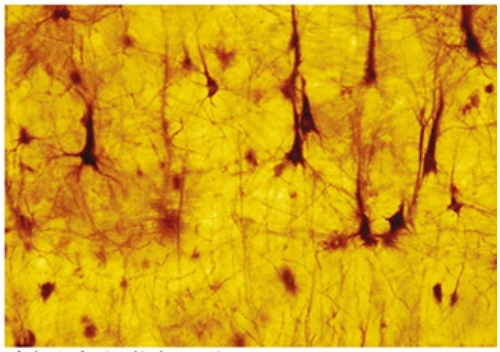

Alain Pol, ISM/Science Source

Alzheimer's disease **Both senile plaques (protein fragments that accumulate between neurons) and neurofibrillary tangles (insoluble fibres that twist together) are thought to damage neurons in the brains of Alzheimer's patients (both shown on the left). Plaques and tangles are absent in the healthy brain (right).**

Gender and Dementia

Depending on whether you are a male or a female, you may be susceptible to different risk factors for dementia and Alzheimer's disease. Older women are more likely to develop dementia than men. Although this may be because women tend to live longer, natural age-related declines in estrogen (which is known to have a protective effect in the brain) could also be a factor (Ma, Lin, & Wang, 2017).

As we age, certain conditions in men and women may increase the likelihood of developing dementia. A study of adults with mild cognitive impairment showed that stroke in men and women and depression and diabetes in women increase the risk for dementia (Chatterjee et al., 2016; Neergaard et al., 2016). In addition to risk factors, Alzheimer's disease also may "look" different in men and women. The brains of women with the disease, for example, typically have many more neurofibrillary tangles than do those of men. Also, men with Alzheimer's disease tend to be more aggressive, while women are more likely to become depressed (Mazure & Swendsen, 2016).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

19. Compare and contrast retrograde and anterograde amnesia. What are the likely causes of both?

20. What changes happen in the brains of people with Alzheimer's disease?

21. How do dissociative disorders differ from organic memory disorders?

What Do You Think? • Do you think that media portrayals of amnesia and dissociative disorders have actually influenced psychotherapists and members of the public to increase the number of diagnoses of these conditions? What other reasons might explain increased diagnoses?

Summary

What Is Memory?

LEARNING OBJECTIVE 1 Define the basic activities of memory and describe two major models of memory.

Memory is our faculty for holding on to past events and past learning. It involves three basic activities: encoding, storage, and retrieval.

Researchers typically take an information-processing approach to memory, talking about different memory stores that work together in a similar way to parts of a computer, each serving particular functions and holding information for varying lengths of time.

PDP or connectionist models of memory suggest that information is stored not in a particular neuron or location in the brain, but instead across a network of connections.

How Do We Encode Information into Memory?

LEARNING OBJECTIVE 2 Describe how information is encoded and transferred among different memory stores and what we can do to enhance encoding.

Encoding refers to taking information in and putting it into memory.

Encoding can happen either automatically or through effortful processing. Either way, however, a person must attend to something to put it into memory.

One of the most common means of effortful processing is rehearsal of material.

Encoding takes place in the form of phonological, sound, or visual codes.

How Do We Store Memories?

LEARNING OBJECTIVE 3 Describe how we organize and store information in working and long-term memory and how we can enhance our long-term memories.

The retention of information in memory is known as storage. Information can be stored in memory for anywhere from fractions of a second to a lifetime.

Sensory memory is the equivalent of the small buffer on your computer, holding a very brief visual or auditory copy of information so you can decide whether or not to encode it into working or long-term memory. Sensory memory may also help maintain the continuity of your sensory input.

Working memory is a short-term store of slightly more information that allows us to conduct simple calculations, such as memorizing a phone number so we can dial it immediately, or remembering the beginning of a sentence as we come to the end of the sentence.

It appears that, without rehearsal, we can hold 7 ± 2 pieces of information in working memory, although we can expand that capacity through techniques such as chunking.

Long-term memory appears to be both infinite in capacity and storage time.

Information taken from working memory into long-term memory appears to be organized according to its meaningfulness and relation to other concepts in long-term storage.

Information in long-term memory may be stored in the form of explicit memories of facts or in implicit memories, knowledge about how to do something. A person cannot always articulate implicit knowledge.

How Do We Retrieve Memories?

LEARNING OBJECTIVE 4 Describe how we retrieve information from memory and how retrieval cues, priming, context, and emotion can affect retrieval.

The access of information from memory is known as retrieval. Retrieval can be facilitated by retrieval cues that make memories easier to access.

Retrieval cues can include priming, context, and enhancing meaningfulness of the memory by making them more personally or emotionally relevant.

Why Do We Forget and Misremember?

LEARNING OBJECTIVE 5 Summarize key theories of why we forget information and sometimes distort or manufacture memories.

Forgetting is the inability to recall information that has previously been encoded.

Initially, researchers believed that failure to access information regularly led to its loss from awareness, a theory known as decay theory. This theory is less popular now, and researchers instead emphasize other problems with remembering.

Interference theory suggests that information gets in the way of proper encoding of information, preventing it from being remembered later. Retroactive interference comes from new information that interferes with previous memories. Proactive interference comes from earlier memories that interfere with new ones.

Motivated forgetting hypothesizes that we try to purposely forget information that is unpleasant, embarrassing, or painful.

In addition to being forgotten, memories can also be distorted or manufactured. We can make source misattributions, where we forget where information came from. We can also be exposed to new information that distorts previous information (as described in interference theory). Also, our own imaginations can play a role in distorting how our memories play out.

Memory and the Brain

LEARNING OBJECTIVE 6 Describe how the brain is involved in memory.

Because scientists have not been able to pinpoint the place where memories are stored in the brain, they have concluded that there is no single storehouse. Instead, memory appears to be a process, resulting from activation patterns throughout the brain.

However, structures like the prefrontal cortex are extremely important in helping people hold information in working memory and to work with it as long as it is needed. Also, the hippocampus and other parts of the neocortex appear to be important in the transfer of memories into long-term memory.

Memory itself appears to be a neural circuit, a network of neurons predisposed to trigger one another whenever one is activated. Through a phenomenon called long-term potentiation, repeated stimulation of certain nerve cells increases the likelihood that the neurons will respond strongly whenever stimulated.

Memories in the Young and Old

LEARNING OBJECTIVE 7 Describe the kinds of memories and memory changes that characterize early life and later life.

Babies and toddlers display many memories—from memories of faces, places, and objects, to memories of skills and procedures. But they do not retain memories of life events for very long.

The slow development of the hippocampus may be responsible for the slow development of life event memories.

Physical exercise seems to help prevent or slow down memory decline more than cognitive exercise does.

Disorders of Memory

LEARNING OBJECTIVE 8 Describe physical and psychological disorders that disrupt memory.

Disorders of memory can come about through aging, brain trauma, or the experience of traumatic events. Organic memory disorders, involving physical causes, include disorders such as amnesia and dementia. Major losses of memory without a clear physical cause are known as dissociative disorders.

Amnesia is the inability to remember things before (retrograde) or after (anterograde) an organic event, such as a head injury or brain surgery.

The other major class of organic memory disorders is dementia, characterized by severe memory problems combined with losses in at least one other cognitive function, such as abstract thinking or language.

The most common form of dementia is Alzheimer's disease, a severe progressive form of dementia that accounts for at least half of all dementia cases.

The brains of people with Alzheimer's disease have an extraordinarily high number of neurofibrillary tangles and senile plaques. The disease may stem from malfunctions of certain proteins or neurotransmitters involved in the normal formation of memories. A tendency toward developing these biochemical problems may be genetically inherited.

Key Terms

Alzheimer's disease

amnestic disorders

anterograde amnesia

automatic processing

chunking

context

decay theory

dementia
effortful processing
encoding
encoding specificity principle
episodic memory
explicit memory
flashbulb memories
forgetting
implicit memory
information-processing model
interference theory
long-term memory
long-term potentiation (LTP)
memory
memory consolidation
memory span
mnemonic devices
neurofibrillary tangles
parallel distributed-processing (PDP) (or connectionist) model
potentiation
prefrontal cortex
priming
proactive interference
prospective memory
recall tasks
recognition tasks
rehearsal
repression
retrieval
retrieval cues
retroactive interference
retrograde amnesia
retrospective memory

schemas

semantic code

semantic memory

senile plaques

sensory memory

source misattribution

spaced practice effect

state-dependent memory

storage

working memory

Self-Study Questions

Multiple Choice

1. Which of the following sequences best reflects the order of stages in the three-stage memory model, from first to last?

a. sensory memory → long-term memory → working memory

b. sensory memory → working memory → long-term memory

c. working memory → long-term memory → sensory memory

d. working memory → sensory memory → long-term memory

2. For encoding to occur, individuals need to focus on environmental stimuli. This "focus" refers to what cognitive process?

a. attention

b. invigoration

c. retrieval

d. storage

3. An experimenter is reading a series of digits aloud for a respondent to recite back from memory in the order they were read. The experimenter is testing the capacity of _____ memory, and the longest string the respondent is likely to be able to repeat correctly is _____ digits.

a. sensory; 3

b. sensory; 7

c. working; 3

d. working; 7

4. Multiple choice test is to essay test as _____ is to _____.

a. cueing; priming

b. explicit memory; implicit memory

c. recall; recognition

d. recognition; recall

5. What does the forgetting curve discovered by Ebbinghaus tell us about the way we forget material over time?

a. At first, we forget very little of what we have learned, but as time passes, the rate of forgetting accelerates.

b. Most forgetting happens immediately after we learn material; the rate of forgetting slows down as time goes by.

c. We forget information at a constant rate as time passes.

d. We forget information at a variable and unpredictable rate as time passes.

6. The need to reconstruct rather than simply retrieve memories stems from the _____ code used in long-term memory.

a. orthographic

b. phonological

c. semantic

d. visual

7. How do the results of Lashley's research on maze memory among rats inform an evaluation of connectionist models of memory?

a. They cast serious doubt on connectionist models of memory.

b. They offer strong support for connectionist models of memory.

c. They pose a challenge for connectionist models of memory.

d. They say little with respect to connectionist models of memory.

8. Which statement best describes the role of the hippocampus in memory?

a. The hippocampus helps encode procedural memories, but not semantic ones.

b. The hippocampus is a temporary storage site for the transfer of long-term memory for the encoding of material into long-term memory and may store some autobiographical memories.

c. The hippocampus is the final repository for long-term episodic and semantic memories.

d. The hippocampus serves to transfer material from sensory to working memory in a process researchers call consolidation.

9. In terms of helping to slow or prevent memory loss in older adults, which strategy has received the most research support?

a. completing puzzles

b. engaging in physical exercise

c. playing computer games

d. taking vitamins

10. Symptoms accompanying progressive neurodegerative diseases characterized by memory loss are called

a. dementia.

b. Alzheimer's disease.

c. Parkinson's disease.

d. dopaminergic losses.

Fill-in-the-Blank

1. According to the information-processing model of memory, _____ is the first stage in which an image is retained by the brain for less than 1 second.

2. The _____ model of memory emphasizes how memories are formed and stored in a network of connections throughout the brain.

3. _____, or consciously repeating information, increases the likelihood of information being encoded into working memory.

4. Remembering a fact based on general knowledge requires _____ memory.

5. A stimulus reminding us of the information we need to retrieve from memory is termed a retrieval _____.

6. In _____ interference, information learned earlier disrupts the recall of information learned more recently; in _____ interference, recently learned information disrupts the recall of information learned earlier.

7. Adults with damage to the _____ typically find that their long-term memories are intact with the exception of memories formed just prior to the brain damage.

8. Our inability to remember events prior to age 3 or 4 is called _____ amnesia.

9. Older adults tend to have more trouble than younger adults with _____ memory, which can make it difficult for them to remember future planned events such as shopping for particular items at the grocery store.

10. Women have higher rates of dementia than men, partly because they live longer, and partly due to declines in the hormone _____ that occur with aging.

CHAPTER 9
Language and Thought

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CHAPTER OUTLINE

Language

LEARNING OBJECTIVE 1 Define language, describe how we learn languages, describe parts of the brain that are involved in language, and discuss differences and problems that can affect people's language skills.

The Relationship between Language and Thought

LEARNING OBJECTIVE 2 Describe how thought and language are related and summarize the linguistic relativity hypothesis.

Thought

LEARNING OBJECTIVE 3 Describe and summarize research on thinking processes, including problem solving, decision making, and metacognition.

You use language to gather information, to share information with others, and to make and maintain the many social connections and relationships that fill your life. Where and how that communication occurs has changed rather dramatically in recent years. Most Canadians, 88 percent, have a cellphone and most Canadian homes, 87 percent, have an Internet connection (CRTC, 2019). Almost all, 97 percent, of Canadians 18 to 24 years of age (sometimes referred to as Gen Z or as iGen) own a smart phone and are much more likely to use their smart phones as their primary device, compared with Canadians in other age groups, for activities ranging from reviewing emails to accessing social media or getting directions, even when at home (Catalyst, 2015; GlobalWebIndex, 2019). People born since 1994, who are now over 18, spend less time than previous generations engaged in in-person or face-to-face interactions with peers, including getting together with friends, going to parties, going out, dating, going to movies, or riding in cars for fun. In fact, they

spend less than one hour a day engaging in in-person social interaction (Twenge, Spitzberg, & Campbell, 2019). As isolated as that sounds, however, they are still socially connected as they spend, on average, 4 hours and 15 minutes on their smart phones each day, which is the highest of any age group (GlobalWebIndex, 2019). It might seem that virtual interaction and communication is replacing in-person social interaction but it is actually more complicated than that, because levels of in-person social interaction are positively correlated with social media use, suggesting that highly-connected people use many means of communication. As well, general levels of reported loneliness have increased dramatically since 2011 and yet adolescents and emerging adults who are lowest in in-person social interaction and highest in social media use tend to report feeling the most lonely (Twenge et al., 2019).

As this text was being prepared, as we were trying to sort out just what research questions needed to be asked to better understand the effects of non-in-person communication, we essentially entered a huge social experiment brought on by the outbreak of the COVID-19 pandemic. Most colleges and universities had shifted all of their courses from face-to-face to online, many people were working from home, and all were being asked to engage in social distancing by maintaining a bicycle-length distance between one another and refraining from sociocultural contact norms, like handshaking, cheek kissing, hugging, or touching. The meaning of those sorts of social norms may seem obscure but they are important parts of communication and stopping them suddenly can be quite disorienting. Classes were being run remotely either as recorded podcasts or videocasts or live using services like Zoom, Skype, or FaceTime, and meetings were happening online as well. For students, whose overall levels of anxiety were already historically high, it was not yet clear whether this shift to almost 100 percent online social and academic living would add to or reduce levels of anxiety.

As responses to the COVID-19 pandemic were unfolding globally, it was not clear what the spinoffs from this shift to such high levels of virtual social interaction would be. Some speculated that it could lead to a "social recession," rife with loneliness and isolation (Murthy & Chen, 2020), but as this textbook was being written, it was too early to tell how the situation would unfold. What is worth remembering is that our use of language—spoken communication—is one of our most amazing and creative evolutionary adaptations. Given this, while it was safe to say that things would be quite different during the pandemic, it will also likely be quite fascinating to note how humans adapt to our new communication realities and challenges. YouTube videos showing Italians in pandemic lockdown singing and playing music with one another on their balconies were only an early example of the sorts of creative social and communicative adaptation we will undoubtedly see much more of. Language evolved as a means for connecting socially and communicating, and creativity is an inherent part of the adaptive power of language.

Language and thought are characteristics that distinguish humans from other creatures. Language enables us to communicate in a precise and often creative way. We also use language to tell stories or jokes. Language has allowed us, as a species, to learn from past generations, originally by oral storytelling and then by written language. Language is a critical component of human behaviour because it greatly facilitates progressive social interactions. Consider the difficulty involved in organizing a large group of people to build a city. Such a feat would be nearly impossible without the use of language.

Although language is communicative, sometimes we use language only in our own heads. We often think using words, but many of our thoughts are not shared. Some people write extensively but only for themselves, never intending or wanting others to read their written words. Although the processes of language and thought overlap, a clear difference exists between them. In general, psychologists study these processes separately.

Human thought is highly complex, varies from individual to individual, and takes on many different forms. The study of thought is a major component of cognitive psychology. As we saw in Chapter 1, the word **cognition** refers to a variety of mental processes that contribute to thinking and knowing. Cognition is involved in learning and memory, as well as in thinking. In this chapter, we will discuss a number of different types of thinking, which can involve accumulating knowledge, solving problems, making decisions, and even thinking about thinking.

cognition mental processes of thinking and knowing.

Language

LEARNING OBJECTIVE 1

Define language, describe how we learn languages, describe parts of the brain that are involved in language, and discuss differences and problems that can affect people's language skills.

What Is Language?

Language, whether spoken, signed, or written, is a set of symbols used to communicate. We use symbols, mainly words, to convey our thoughts and desires to others who share an understanding of those symbols. Language can be divided into two main components: language production and language comprehension. **Language production** occurs when we generate thought through words. **Speech** involves the expression of language through sounds. Human language production is *generative* or creative; we make new sentences whenever we speak, rather than just restating old ones. In fact, humans have a remarkable capacity for producing new sentences, and we rarely repeat previously-heard sentences word-for-word. The ability to produce new sentences spontaneously and creatively is an important feature of human communication. We know that many other species communicate with sounds, but the vocalizations uttered by most species are inborn and do not change (see photo). A lion does not need to learn how to roar, for example, and it does not phrase its roar differently every time.

language a set of symbols used to communicate.

language production the structured and conventional expression of thoughts through words.

speech the expression of language through sounds.

TungBooWat/iStockphoto

Language? . . . not These canaries may appear to be discussing how beautiful a day it is or how well their offspring fly. However, although the word-like sounds they emit involve communication (that is, the sharing of information), they do not amount to language.

Very few species other than humans can learn new *vocalizations*, sounds produced in an effort to communicate (Oller et al., 2019; Bernabeu & Vogt, 2015). Vocal learning occurs in some species of songbirds (canaries, zebra finches), bats, aquatic mammals (whales and dolphins), and humans. It may come as a surprise that no primates other than humans learn language naturally, although monkeys and apes have an extensive repertoire of species-specific vocalizations and baboons are able to learn to recognize words (Fagot et al., 2019). However, apes that have learned some vocalizations are not capable of the complexities that characterize human language. Despite years of training in the laboratory, for example, no ape has ever learned to speak, as they lack the vocal apparatus that humans evolved over many thousands of years. Gorillas are able to use a range of signs to communicate. For example, the gorilla Koko, who passed away in 2018 at 46 years of age, learned over 1,000 American Sign Language-based signs (Gold & Watson, 2018; Perlman & Clark, 2015; Peng, Fouts, & Rumbaugh, 2019). (See photo.) See if you can understand Koko's signs here: www.youtube.com/watch?v=SNuZ4OE6vCk. Alternatively, follow Sean Senechal's approach to teaching your dog some basic signs—using K9Sign (Senechal, 2012).

Ron Cohn/The Gorilla Foundation, koko.org

Sign language **Koko was able to use over 1,000 recognizable gestures from American Sign Language.**

Humans are also endowed with an impressive capacity for **language comprehension**, the ability to understand communicative vocalizations or gestures. We can generally comprehend fragments of sentences or words that are mispronounced. We can understand people who speak with accents (Bent & Atagi, 2017), people with speech impediments, such as lisps or stutters, as well as immature speech, such as the speech of toddlers (Hernández et al., 2019). Our ability to understand speech that is incomplete or unclear is related to the fact that much of language comprehension is automatic. Typically we understand spoken language without concentrating, which is the reason we are able to carry on a conversation with limited pauses before responding.

language comprehension the process of understanding spoken, written, or signed language.

Language Structure

The study of speech can be divided into four general areas: *phonology*, *semantics*, *syntax*, and *pragmatics*. **Figure 9.1** shows the building blocks of language. The smallest units of sound in any language are called **phonemes**, and the study of how sounds are put together to form words is called **phonology**. For example, the word *tip* has three phonemes—*t*, *i*, and *p*. The number of phonemes differs from language to language (Yu & Zellou, 2019). The English language has about 40 phonemes (give or take a few depending on the dialect). At

one end of the spectrum is the language Pirahã, an Indigenous language of Brazilian people living in the Amazon, which has only 10 phonemes. At the other end of the spectrum is the Taa language (also known as !Xóõ), a language of Indigenous people of Botswana and Namibia, which has 141 phonemes.

> **phoneme** the smallest unit of sound in a language; an individual sound such as ba, da, or ta.
>
> **phonology** the study of how individual sounds or phonemes are used to produce language.

Janet Werker at the University of British Columbia has demonstrated that speakers of one language often cannot distinguish sounds of other languages if their own language does not include the phoneme (Yeung, Chen, & Werker, 2013; Werker, 2018). For example, French does not include the *h* sound at the beginning of words. French speakers would say, "'Ave you 'eard about 'arry?" When learning English, French speakers will often overcompensate by voicing the *h* sounds in words where English speakers largely omit them, such as "hour" or "honour." Such errors are particularly noticeable in older speakers learning a new language (in this case English). Later in this chapter we discuss how it is much easier to learn languages during an early stage of life.

While phonemes are sounds, **morphemes** are the smallest units of language that convey *meaning* or *function* (Shi, 2014; Kuczaj & Barrett, 2012). For example, the word *jumped* has two morphemes. One is *jump* and the other is *ed* (the *ed* morpheme changes the meaning, indicating that the jumping has already taken place). Therefore, words can contain more than one morpheme, but each morpheme is not necessarily a word (that is, *ed* cannot stand alone and convey meaning). The study of the meaning of words is referred to as **semantics**. For example, if we say that it is "raining cats and dogs," you do not look outside and expect to see animals falling from the sky. Instead, you know that this expression means that it is raining very heavily. The dictionary meaning of a word is referred to as its **lexical meaning**. Lexical meaning changes over time. Consider the word *awful*; it used to mean "full of awe," but now means that something is extremely bad or unpleasant. Non-lexical sounds or words are things like *hmmmm* or *ahhhh* that require observational experience to understand how and when they are used in social interaction in one's language community (Keevallik & Ogden, 2020).

> **morpheme** the smallest units of a language that convey meaning.
>
> **semantics** the study of how meaning in language is constructed of individual words and sentences.
>
> **lexical meaning** dictionary meaning of a word.

Knowing the meaning of individual words is important, but a word's meaning is often communicated through the position of the word in a sentence. For example, if you say that Joe kissed Kelly, then your listener knows that Joe was the giver of the kiss and that Kelly was the receiver. If, however, you say that Kelly kissed Joe, then the listener knows that Kelly was the giver of the kiss and that Joe was the receiver. As well, one word can mean

two things; for example, the word *blue* can mean a colour or a depressed emotional state. When heard alone, it's impossible to tell the intended meaning. However, when we hear *blue* in the context of a particular sentence, such as, "She wore a beautiful blue dress," or, "He's feeling blue today," the distinction becomes instantly clear. The way in which words are constructed into sentences is referred to as **syntax**.

syntax the system for using words (semantics) and word order to convey meaning (grammar).

Phonology, semantics, and syntax bring us to the point where we have sounds, words, and sentences. Communication also requires adhering to social norms, such as speed of speech, responding at appropriate intervals, making eye contact, and using acceptable body language. These aspects of communication are called **pragmatics**, because they refer to the practical use of language.

pragmatics the practical aspects of language usage, including speech pace, gesturing, and body language.

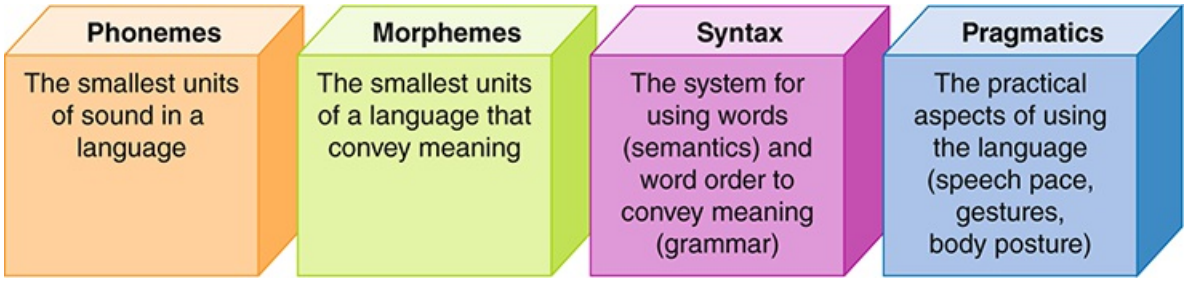


FIGURE 9.1 The building blocks of language

One aspect of pragmatics is our use of body language, or **non-verbal communication** (see photo). The way we move our hands, bodies, and faces can change the connotations of our speech. Suppose your instructor said, "I would like to meet with you after class." If this statement was delivered with one raised eyebrow, a sneer, and arms folded across the chest, you would likely interpret it differently than if the instructor said the sentence with a warm smile, while leaning forward with hands on a desk. Some people are not aware of the body language they are using and unwittingly send the wrong message when they attempt to communicate. An employee may believe, for example, that a boss is making inappropriate advances because the boss is unaware of the message he or she sends by standing close and touching the worker's arm while talking. Things like how close we stand to others as we interact with them also have meaning. Too close is interpreted as pushy or threatening and too far is interpreted as rude or dismissive, though all of those conventions were tossed out with the social distancing advice during the COVID-19 pandemic, which required both social and individual interpretive adjustments (Hadley, Brimijoin, & Whitmer, 2019; Judge, 2020).

non-verbal communication body language.

Adrian Wyld/The Canadian Press

Getting his message across Prime Minister Justin Trudeau's embrace of the late Gord Downie during an Assembly of First Nations ceremony honouring the musician communicates his congratulations and support.

Non-verbal communication seems to be acquired automatically, often by observing the actions of others. Non-verbal communication is related to, but not identical to, gesturing, which refers to communicative movements of the arms and hands. Gesturing facilitates speech production. While the ancient Greeks provided orators with explicit lessons in gesturing to enhance their speeches, studies have shown that gesturing appears to be innate (Byrne & Cochet, 2017; Zlatev, 2015). For example, people blind from birth, who have not had the chance to learn gestures by watching others, nevertheless use gestures when they speak. Gesturing is often difficult to inhibit; blind people will gesture even when they are talking to another blind person (Jelec & Jaworska, 2014; Fenlon, et al., 2019). Research has shown that blind students can be helped to grasp mathematical concepts or even learn to play the piano more quickly if they get information about their instructors' gestures by having the instructor wear a haptic glove interface (a glove that records information about hand movements and touch) (Quek & Oliveira, 2013; Pala & Türker, 2019).

How Language Develops

You were probably too young at the time you started to speak your native language to remember learning it. Your parents may have proudly kept a record of your first words. If they did, they probably abandoned the list pretty soon, as it became too long very quickly. Within just a few years, almost every human baby goes from being incapable of speaking or understanding language to having an extensive vocabulary (see photo).

Marina_Di/iStockphoto

Baby talk **Infants' productive vocabulary goes from zero to 50 words in 18 months and over the same time frame their comprehension vocabulary increases to three times their production level.**

Prevocal learning Between 2 and 4 months of age, babies (with normal hearing) are capable of perceiving the phonemes of every language, including those that are not needed for the language(s) they will ultimately learn (Horst & von Koss Torkildsen, 2019). During this time, babies have a remarkable ability to distinguish among these sounds. Researchers investigated babies' abilities to distinguish among different phonemes by training the babies to turn their heads toward an interesting visual reward when they hear a change in speech sounds. Results of studies by UBC's Janet Werker and others using this type of training (which is a form of operant or instrumental conditioning, as described in Chapter 7) suggest that young babies can discern a much wider range of phonemes than older children or adults can (Werker, 1989). This ability declines, however, as babies begin to learn their native language (Sundara et al., 2018). With practice in only the phonemes of our native language, we lose the ability to distinguish among sounds that are only heard in other languages (Kuhl, 2010; Yule, 2017). This pruning of phoneme processing happens without specific training, and clearly suggests that infants arrive ready to notice, tune into, and acquire the language(s) being spoken around them.

Cooing By about 2 months of age, babies begin to make a non-crying vocalization that consists largely of vowel-like sounds (e.g., o-o-o-o-u-u-u). Infants may also produce brief consonant-like sounds that sound somewhat like a *k* or *g*. Although infants occasionally produce these sounds when alone, they largely appear when the infant is interacting with someone else (Asada, 2016; Murray et al., 2016).

Babbling By about 6 months, babies start to babble (Elmlinger, Schwade, & Goldstein, 2019). **Babbling** refers to the production of meaningless speech sounds either repetitively (e.g., da-da-da-da-da) or in a more mixed manner (e.g., pa-da-ca-ca-mi-den-bo). These vocalizations do not work as communication, but they do enable the infant to experiment with vocalizations in a way that gradually approaches their soon-

to-be-acquired native language. All babies babble, including those who are deaf (Blamey & Sarant, 2013; Brice, Plotkin, & Reesman, 2016).

First words By about 1 year, speaking begins, typically in the form of very simple words, such as *mama*, *dada*, or *hi* (Perlman, Fusaroli, Fein, & Naigles, 2017; Menn & Stoel-Gammon, 2017). At this early stage, the baby's ability to comprehend is much greater than the ability to speak (see **Figure 9.2**). At about 1 year of age, the average baby can understand approximately 50 words, but he will not be able to speak that many words until about months later (Yule, 2017; Hansen & Broekhuizen, 2019). One-year-olds can often follow commands, such as, "Get the ball and bring it to mommy," even though their spoken vocabulary may only include *ball* and *mama*.

Telegraphic speech By age 2, toddlers in most language communities speak in very short (typically two-word) sentences. This is called **telegraphic speech** because, as in old-fashioned telegraph messages (for which senders were charged by the word), all but the essential words are omitted. Instead of saying, "I want a cookie," a 2-year-old is more likely to simply say, "Want cookie." The order of the words used varies by linguistic group (for example, "Give cookie" in English and "Cookie give" in Japanese) (Bloom, 2013). The dropped words are called grammatical morphemes and they are only dropped when they are not necessary to determine the meaning of the spoken phrase in their language community (Slobin, 2014).

Pragmatics By 3 years of age, the average toddler has naturally acquired some practical information about language use, including the need to pause between sentences and the knowledge that certain sentences are statements, whereas others are requests (Matthews, 2014; Adamson, 2018). The average English-speaking 3-year-old vocabulary typically includes about 1,000 words (Huttenlocher et al., 1991; Bleses et al., 2016).

Grammar By age 4, children have automatically absorbed many of the rules of grammar, even though they have received no formal education about the grammar of their native languages (Tager-Flusberg, 2001; Justice et al., 2018). As discussed below, some of the early stages of reading often emerge around this time when children are exposed to written words at home or preschool. By age 6, the average child uses almost 3,000 words and likely understands a great many more, about 14,000 words (depending on the amount of language they were previously exposed to—see the feature, Practically Speaking 9.1: Poverty and Language Development). By age 9, practical aspects of language emerge, such as inferring meaning of obscure language, interpreting metaphors, and understanding sophisticated humour (Wellman, 2014).

babbling babies' production of meaningless sounds.

telegraphic speech speech that consists of minimalistic sentences; characterizes early toddlerhood and is the first evidence of sentence formation.

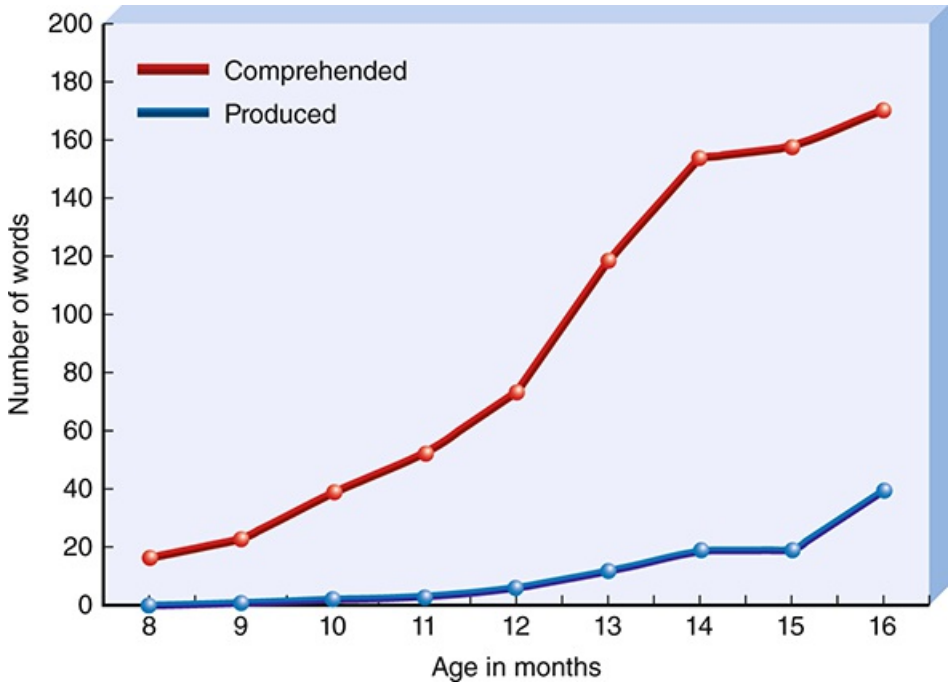


FIGURE 9.2 Babies' comprehension of words Babies can comprehend more words than they can speak. One-year-old babies understand about 50 words, but will not be able to speak them until about months later.

Adapted with permission from Fenson, L., Dale, P.S., Reznick, J.S., et al. (1994). Variability in early communicative development. *Monographs of the Society for Research in Child Development*, 59(5, Serial No. 173), Blackwell Publishers; based on Lilienfeld, S., Lynn, S., Namy, L., & Wolf, N. (2008). *Psychology: From inquiry to understanding*. Boston: Pearson/Allyn & Bacon, Figure 8-3, p. 325.

Even though the majority of language learning occurs relatively early in life, vocabulary and its usage can continue to increase in size and sophistication for decades to come. In studying for the Graduate Record Exam (part of the application process for many graduate programs, including psychology) or other university- or college-admission exams, many young adults find themselves learning words they haven't used before. Vocabulary can increase throughout adulthood, and seems to be one type of memory that is not adversely affected by the normal aging process. Elderly people with slowed reaction times and impaired memory for events in their own lives often score as high, if not higher, than young adults on vocabulary tests (Moscoso del Prado Martín, 2017; Salthouse, 2017).

9.1 Practically Speaking

Poverty and Language Development

Children from socio-economically disadvantaged backgrounds often struggle in academic settings. In fact, several studies suggest that poor children have deficient vocabularies when they first enter elementary school, and that these differences often get exaggerated as the years pass because vocabulary builds on itself (Fernald, Marchman, & Weisleder, 2012; Schwab & Lew-Williams, 2016).

Research has shown that the initial language deficits of poor children are due to differences in their linguistic environments. On average, as infants, toddlers, and young children, students from lower socio-economic status (SES) households are exposed to fewer words than are students from households with higher socio-economic status. As shown in the table, one study found that, in any given hour, children in poor homes heard fewer than half the number of words than children in high SES homes did (Fernald et al., 2012). In addition, much more of the speech to which poor children were exposed was prohibitive; for example, when a parent says, "Stop it!" or "Don't touch that."

The exact reasons why poor parents communicate less, as well as less positively, with their children remain unknown. The stress of poverty and the potential lack of suitable role models for parents (parenting skills are largely acquired through one's own upbringing) are two likely causes. Work by Monique Sénéchal and Jo-Anne LeFevre (2002, 2014) at Carleton University highlights the good news that the problem of reduced vocabularies in lower SES children can be prevented by preschool intervention that includes educating parents about the benefits of talking and reading to children in the home.

Research in this area also highlights one of the key challenges with human research: we are a lot better at carefully observing human behaviour (the *whats*, as in *what is going on?*) than we are at understanding the reasons for observed behaviour (the *whys*). Finding out the underlying causes of human behaviour is understandably harder as we are ethically unable to experiment on many aspects of human condition. So, we can *see* that there appear to be SES differences in parent–child communication, but at the same time we are not really clear on *why* those observed differences exist. It is especially important that we identify what the causes are in situations like this, as we may be able to design intervention programs to lessen or remove conditions of disadvantage.

PhotoEuphoria/iStockphoto

Socio-Economic Status	Words per Hour	Affirmations	Prohibitions
Low SES	176	5	11

Mid SES	251	12	7
High SES	487	32	5

Theories of Language Development

Think about experiences you have had building your vocabulary, perhaps to take exams or as part of an English course. You may also have had experience learning a second or third language later in your education, perhaps starting in late elementary school or even in high school. In either situation, whether expanding your vocabulary in your first language or adding an entirely new language, you probably experienced a much slower learning rate than you did when you learned your first language as a very young child. Language-related learning later in life probably also required concentrated attention to your studies; it most likely did not occur automatically.

The ease with which language is acquired by human infants has led many researchers to speculate that language has a biological basis. The linguist Noam Chomsky was among the first to suggest that language learning is built into our brains (Chomsky, 1964). The brain does appear to be set up to understand and communicate using language. As we have noted, the ability to detect all phonemes used in any human language exists in all human babies (as long as their hearing is intact). Other studies have also shown that the very young brain is wired to acquire language rapidly and automatically, because it is in a highly plastic, or changeable, state, ready to absorb new information about language. As humans grow and reach adulthood, the brain maintains the ability to change, but that ability diminishes (Johnson & Newport, 1989; Šarić & Obad, 2015)—language learning becomes much slower and requires more effort.

Chomsky described our early capacity for language learning as working as if we had a sort of *language acquisition device* built in to our brains. As we have seen, the influence of this theoretic "device" may fade as we age and become more cognitively aware of our learning processes. Psychologists often refer to the childhood years before age 13 as an especially important period for language acquisition (Finn, Lee, Kraus, & Kam, 2014; Werker & Hensch, 2015). Some debate exists as to whether language systems have a critical or a sensitive period (Patton, Blundon, & Zakharenko, 2019). Recall from Chapter 4 that a **critical period** is a window of time during which certain influences are *necessary* for appropriate formation of the brain. After the critical period, these influences are no longer capable of having as profound an impact on the brain. A **sensitive period** is a developmental time during which the brain is more *susceptible* to influences. After the sensitive period, change can still occur, but it doesn't happen as readily (Cheung, Chudek, & Heine, 2011).

critical period a window of time in development during which certain influences are *necessary* for appropriate formation of the brain.

sensitive period a point in development during which the brain is more *susceptible* to influences.

M.L. GRAY/KRT/Newscom

Baby sign **This mother is using child-directed speech to communicate with her toddler, including special intonations in her voice and a modified form of sign language that is simple so her toddler can follow it and that focuses attention on what the mother is talking about. The toddler is also using the same "baby sign" as part of their interaction.**

As we have seen, we can still expand our vocabularies or learn new languages later in life, suggesting that, in normal cases, we go through more of a sensitive period than a critical period for language learning. Some evidence, however, such as from the sad case of Genie described in the next section, suggests that there is a critical period during which we must have *some* language input or we do not acquire normal fluency with speech and, in fact, may miss out on the opportunity to develop a working understanding of the underlying syntactic features of language.

It's clear that our brains have a biological propensity to help us acquire at least one language, but the process of language learning is not exclusively innate. Much evidence suggests that the environment plays a critical role as well. Early behaviourists, including B. F. Skinner (1957), suggested that language is acquired as a result of instrumental conditioning. They argued that toddlers are rewarded with praise for producing appropriate speech, and ignored or scolded for failure to do so. As you may have noticed, however, parents, caregivers, and other older people do not usually systematically reward toddlers for correct speech. The 2-year-old who says, "Want cookie," is just as likely to get one as another child who can ask, "Please, may I have a cookie?" Conditioning alone, therefore, cannot explain language acquisition (Chomsky, 1959; Palmer, 2006).

Interactive theories suggest that experience interacts with biological development to enhance and guide language learning (Lewis et al., 2016; Chung, Chen, & Geva, 2019). As we have described, for instance, if a baby isn't exposed to certain phonemes, her capacity to distinguish among these sounds diminishes over time.

The social environments of most babies and young children also typically offer a high degree of very interactive speech. Most adults in most cultures talk to babies with a special intonation in their voices; a high-pitched and sometimes exaggerated speech that is spoken directly to an infant or child is called **child-directed speech** (Golinkoff, Can, Soderstrom & Hirsch-Pasek, 2015). The patterns of child-directed speech are often rich in emotions, which may have the added benefit of fostering a close emotional relationship between caregiver and child, thus enhancing the quality and quantity of communication.

> **child-directed speech** speech characterized by exaggerated emotional responses and a slower pace that is cross-culturally common among caregivers communicating with babies and young children.

Child-directed speech is also observed when parents use sign language to communicate with babies, though this is different than the "baby sign" shown in the photo. Whether the adult, child, or both are deaf, the use of sign language during the learning phase naturally takes the form of child-directed speech—slower in the formation of the hand signs, with longer pauses in between signs and exaggeration of facial expressions of emotions (Lieberman, Hatrak, & Mayberry, 2014). Child-directed speech arises naturally; people adopt it without any formal instruction, suggesting that humans seem to have a biological predisposition to teach effective communication to the very young (Vouloumanos & Gelfand, 2013; Adamson, 2018).

Cognitive Machines Group

Capturing Time-Worms Researcher Deb Roy, shown here feeding his son in their kitchen, recorded 230,000 hours of audio/video by placing fish-eye cameras and

microphones in every room in his house over the first 3 years of his son's life. This allowed him to study, in detail, the *time-worms* associated with the *birth* of each word in his son's vocabulary and focus in detail on the social contexts in which those word births occurred.

How should we study the roles that child-centred speech and parent–child interaction play in the development of language? We could bring parents and infants into a lab and record their interactions, but such data-gathering opportunities are short and not particularly natural. There is likely a lot more going on in a child's home than can be reliably recorded in a lab setting. Deb Roy decided to get a closer look at the social contexts in which infants produce new words by designing the Human Speechome Project in which he wired an entire home (his) for video and sound (see photo) and recorded 230,000 hours of the first years of a child's (his) life (Roy, 2009; Roy et al., 2015; Meylan, Frank, Roy, & Levy, 2017). By analyzing what he called time-worms, Roy was able to track the emergence of words in his son's vocabulary and study the actual social contexts in which it all occurred. If you watch his TED talk (www.ted.com/talks/deb_roy_the_birth_of_a_word), at about the fifth minute, you can hear how "gaga" turned into "water" over a period of months. Roy was able to track precisely how he, his wife, and their nanny focused their interactions with his son on new words when they were "born" and how they helped him perfect their pronunciation and appropriate use. What is emerging is a very rich understanding of the social interactions and developmental contexts through which words are "born."

The development of syntax, or grammatical rules, also suggests an interaction of biology and environment. Even in children with hearing loss who are not formally trained in sign language but have instead developed their own form of signing, there is evidence of a grammatical structure. These findings suggest that the brain is predisposed to create a set of rules by which language will be used. Grammar rules differ from language to language, but within a given language, they remain the same and are followed fairly consistently by speakers of the language (Tomasello, 2018; Rutherford, 2014).

Even with such a strong biological basis, however, grammar is still affected by environment. We can see the effects of environment when children begin formal education. Children typically acquire a large vocabulary and the ability to form grammatically-correct sentences by about age 4, generally before they receive formal training in grammar (Tomasello, 2014; Justice et al., 2018). Once grammatical rules are consciously learned, however, children become more prone to errors. For example, once children learn that the suffix *-ed* refers to the past tense, they apply *-ed* to verbs that are irregular. A child who previously used the past tense of "*think*" correctly as "*thought*" may begin to say "*thinked*." Such mistakes are referred to as **overregularization** (Guasti, 2017). They provide evidence that, while the tendency to readily pick up syntax exists in the very young, some aspects of grammar are learned. At the very least, there are two systems for language acquisition: one that is automatic and the other that requires conscious attention and can be learned explicitly. Overregularization is an example of how the conscious learning system can interfere with—and actually, temporarily do a worse job than—the unconscious system of language acquisition.

overregularization the process by which elementary school children over-apply newly-learned grammatical rules to improperly "correct" an irregular part of speech,

such as a verb (e.g., “goed” instead of “went”).

Critical Period for Language Learning? The Case of Genie

In 1970, an adolescent girl and her blind mother were delivered to a welfare office in California (Rymer, 1994; Friedmann & Rusou, 2015). At the hands of her sadistic father, the girl, named Genie, had spent her entire life in isolation chained to a potty chair (see photo). She was rarely spoken to except in a punitive way (“stop it”). Her father communicated with her mostly by grunting and barking. At age 13, when her mother finally left the father, Genie had been exposed to almost no speech and appeared to be nearly mute. Her vocabulary consisted of about 20 words.

Bettmann/Getty Images

Portrait of Genie **This photo shows Genie after authorities took control of her care.**

Age 13 is after the time at which most researchers had assumed that the critical period for language acquisition is over. This assumption is based on the fact that after this age, people learn new languages with greater difficulty and typically speak their second languages with accents. Because Genie was 13 years old at the time when she was rescued, she was a tragic test case of whether a critical period for language exists.

During the years that followed her rescue, Genie received extensive, interactive language training. Although she did initially show progress in expanding her vocabulary, it was always limited and didn’t include the acquisition of grammatical rules. Unfortunately, Genie’s vocabulary regressed even further when she was under stress. Genie’s experiences tended to provide support for the theory that a sensitive period for language learning does exist.

Although the case of Genie seems to support the language critical period theory, it’s important to keep in mind that Genie was not only deprived of language, but also subjected to extreme physical and emotional abuse that may have contributed significantly to her inability to learn (Sylvestre, Bussières, & Bouchard, 2016). It has also been suggested that she may have been mildly intellectually disabled at birth, a factor that could partially limit

the critical period theory (Houwen, Visser, van der Putten, & Vlaskamp, 2016). Regardless, it is clear that early experiences are important in first language acquisition (Friedmann & Rusou, 2015).

Learning to Read

In Western cultures, most children begin formal education and start learning to read at around the ages of 5 or 6. Reading is a complicated behaviour that emerges considerably after the foundations of language production and comprehension have been laid down.

Carleton University researchers Monique Sénéchal and Jo-Anne LeFevre have shown that children typically begin the process of learning to read by telling stories from looking at pictures in a book and attempting to recognize a few simple words (Sénéchal & LeFevre, 2001; 2014). In schools in North America, reading and writing are usually a main focus of Grade 1 and Grade 2. By the end of Grade 2 (around age 8), reading becomes much less laborious for most children, as it transitions to an automatic process that requires little or no conscious thought (Cardoso-Martins & Ehri, 2014). At this same point, parents usually start to notice their children excitedly pointing out letters and words they recognize on signs and billboards. Reading becomes challenging and fun as children begin to acquire the basic skills.

Once reading becomes automatic, most people become very proficient at it. Just as we are capable of understanding spoken fragments of sentences or words spoken in foreign accents, we can understand written abbreviations with ease. Consider the abbreviated writing of the text message: U R L8. It's very easy to determine that this means, "You are late," because the phonemes are identical to those that are used to correctly spell out these words. More complicated and non-phonetic written messages require explicit learning. Consider the abbreviated writing of the text message: I ctn I g2g il ttyl. Without prior knowledge of the acronyms *ctn*, *g2g*, and *ttyl*, the message, "I can't talk now, I've got to go, I'll talk to you later" would remain a mystery (Tat & Azuma, 2016).

Language and the Brain

In most people, language production and comprehension centres are located in the left hemisphere of the brain. In a small percentage of people (about 5 percent), the language centres are lateralized to the right hemisphere of the brain. In some cases, language involves both hemispheres (Friederici, 2017). As discussed in Chapter 3, one area of the left hemisphere of the brain, Broca's area, is important for our ability to speak, while another area, Wernicke's area, is important in language comprehension. In a typical conversation, both areas are active at once, along with other parts of the brain.

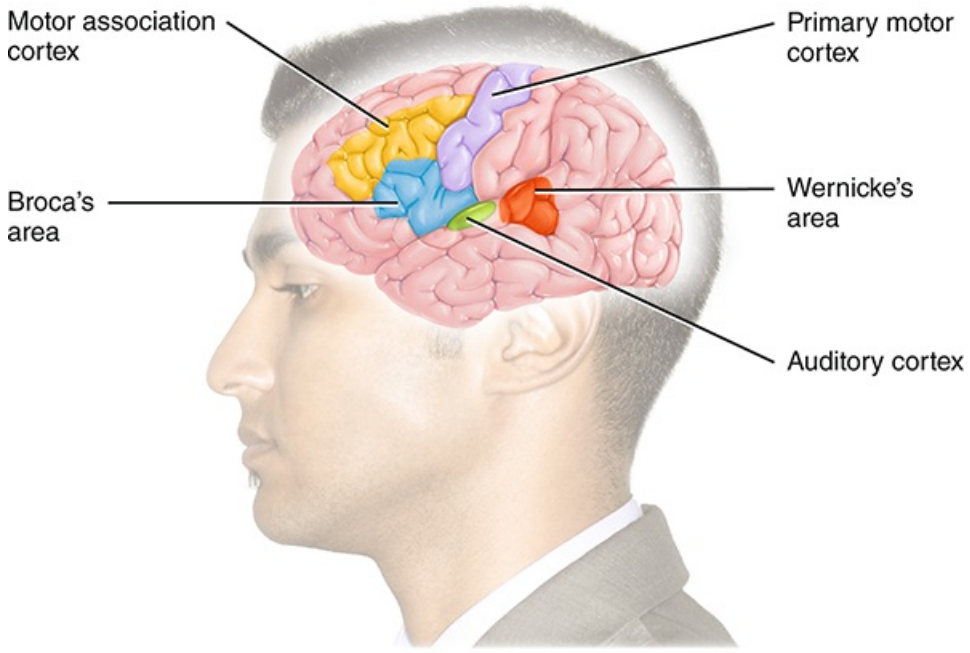
Broca's Area

Broca's area is located in the frontal lobe in what is technically the motor association cortex (Damasio & Geschwind, 1984; Fitch, 2017). (See **Figure 9.3**.) This area was named after the neurologist who first described patients with damage to this region. People who suffer damage in or near Broca's area develop a set of symptoms called **Broca's aphasia**. The term *aphasia* refers to an inability either in language production or in language comprehension. In Broca's aphasia, the problem is with production; people have great

difficulty speaking; they speak unusually slowly and have trouble with pronunciations (Fridriksson et al., 2014).

Broca's area a brain region located in the frontal lobe that is important for speech production.

Broca's aphasia a neurological condition arising from damage to Broca's area where the patient is unable to produce coherent speech.



Asia Images Group/Getty Images

FIGURE 9.3 Language and the brain

Because Broca's area is located in the motor association cortex, many researchers believe that the difficulty in speaking that characterizes Broca's aphasia is caused by difficulties in making the necessary movements. Speaking requires a complex set of movements of the lips, tongue, and larynx, and movements are largely controlled by the primary motor cortex in the brain. The content of patients' speech supports the theory that difficulties in movement, rather than in thinking, are the major problems when Broca's area is damaged. Although difficult to follow, the speech of most people with Broca's aphasia makes sense. They have clear thoughts to communicate, but they have great difficulty getting them out (Broca, 1861; Watila & Balarabe, 2015).

Damage to Broca's area can also produce an inability to speak with proper grammar, a condition referred to as **agrammatism**. This deficit suggests that our ability to use grammar is stored close to or within the same neural tissue that is responsible for speech production (Hillert, 2014; Rogalsky et al., 2018). This close neuroanatomical relationship probably explains how grammar is automatic once it is learned. When we speak, we don't need to carefully construct grammatically correct sentences.

agrammatism a neurological condition arising from damage to a brain region just anterior to Broca's area, where the patient is incapable of using words in grammatical sequence.

Dr Bill Vicars

Canadian Sign Deaf Canadians communicate using either a version of American Sign Language (ASL) or Langue des signes Québécoise (LSQ). The sign above is not found in ASL but is used by Canadian signers to say "Canada." The fist is used to tap the chest, as if you were grabbing the shirt. A mnemonic for remembering this sign is the phrase "The Mounties always get their man" (even if they don't actually grab him by the shirt).

The agrammatism suffered by people with Broca's aphasia also tends to be linked to mild impairments in language comprehension (Ardila, Bernal, & Rosselli, 2016). Individuals affected with this form of aphasia can produce some connected speech, but their speech is missing all of the required grammatical words (such as "the," "is," "and," "ing," "ed," or "s"). So, instead of saying, "She is going," the person with agrammatism might say, "She go." In research, people with Broca's aphasia who were asked to point to the correct picture that illustrated a phrase such as "the cat ate the food" could do so. If researchers asked these people to point to a nonsense picture illustrating the phrase "the cow was on the car," however, they were almost as likely to choose a picture of a car on a cow as to choose the correct one. The researchers concluded that people with Broca's aphasia were not able to use clues such as grammar and word order to determine the meaning of a sentence that was not obvious from its individual words (Druks, 2016; Corina & Blau, 2015).

Neuroimaging studies of people without brain damage have confirmed much of what neurologists and neuropsychologists have discovered from studying the behaviour of people with Broca's aphasia (Narang, Kedia, & Jha, 2017). Broca's area itself is active during speaking, and an area just in front of Broca's area becomes active when we try to

comprehend sentences with complicated grammar.

Sign language uses brain areas similar to those important in spoken language (see photo). Neuroimaging studies show that, in people with intact brains, Broca's area and Wernicke's area are activated during signing (Emmorey, 2015). Since producing sign language does not require actual speech production, it does not involve as much activation of Broca's area. However, because sign language does involve use of grammar to construct meaningful sentences, using sign language activates the same motor cortex areas of neural tissue near Broca's area involved in the use of grammar when speaking. Deaf people with brain damage around Broca's area can experience deficits in grammar use with signing (Corina & Blau, 2015; Raymer & Rothi, 2018).

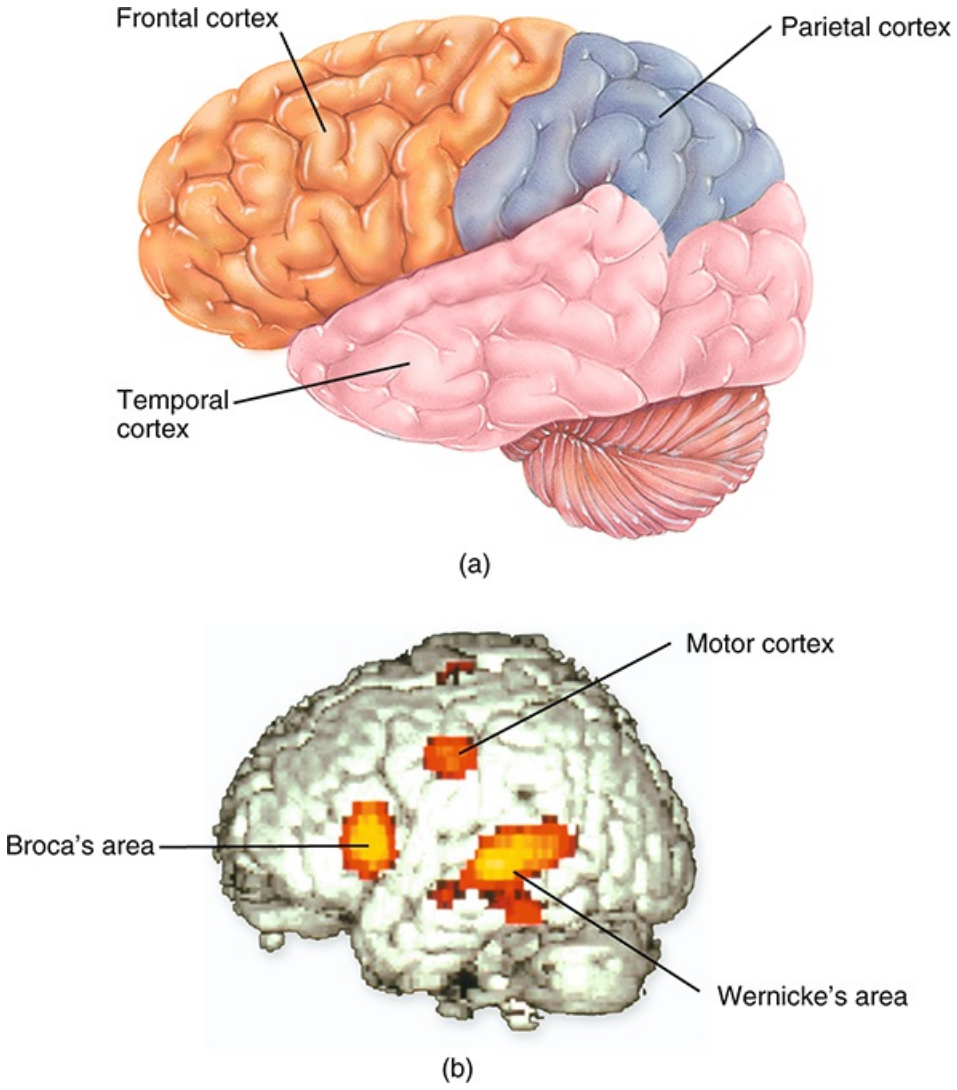


FIGURE 9.4 Scanning for language comprehension The PET scan displays the brain activity of a person who is repeating the words of another individual. Such vocal repetitions activate (red and orange) Broca's area for speech production, Wernicke's area for language comprehension, and a motor region tied to vocalizations.

Wernicke's Area

Although the tissue near Broca's area seems to contribute to the comprehension of grammar in language, other parts of the brain are even more important for language comprehension. Because, for most people, speech comprehension begins when we hear, it is not surprising that the brain regions most important for understanding speech are located near the auditory cortex in the upper part of the left temporal lobe. **Wernicke's area** (see **Figure 9.4**) was first identified by a neurologist named Wernicke, who studied patients with brain damage in this area of the temporal cortex. People who suffer destruction to this part of the brain have **Wernicke's aphasia**. These individuals have impairment in auditory comprehension; they cannot understand speech and therefore produce fluent but disordered speech. In other words, patients with Wernicke's aphasia are fully capable of talking, but their speech makes no sense (Greenwald, 2017). For example, in response to being asked, "Are there flowers on the bush?" a patient might answer something like this, "Yes. I can eat and listen and walking and talking for this now you."

Wernicke's area a brain region located in the temporal lobe that is important for language comprehension.

Wernicke's aphasia a neurological condition associated with damage to Wernicke's area where a person cannot understand language.

Other Brain Regions

In addition to Broca's and Wernicke's areas, other brain regions have important functions in specific aspects of language. For instance, the amygdala, a brain region important for fear and aggression, appears to be involved in the use of profanity (Bartholow, 2017).

Most people also typically use regions in the right hemisphere to understand figurative language, such as metaphors. In figurative language, the meaning of a phrase is different from the literal meaning of the words used in the phrase. Damage to the right hemisphere can lead to taking figurative language literally (Lundgren & Brownell, 2016). For instance, a person might think the phrase "hold your horses" means to grab hold of an actual horse. Metaphors are figures of speech that compare unlike things. Damage to the right hemisphere might lead a person to think that you live with an actual farm animal when you say, "My roommate is a total pig." Perhaps because understanding humour requires a grasp of abstract language—humour often involves the use of puns and metaphors—right hemisphere damage can also disrupt the ability to understand a joke.

A role for the right hemisphere in processing information about metaphors has been demonstrated using the relatively new technique in brain science called *transcranial magnetic stimulation* or *TMS* (discussed in Chapter 3). Researchers can focus TMS, which delivers a strong magnetic signal, into a participant's head to temporarily inactivate a specific brain region. One such study found that TMS of the right hemisphere temporarily impaired the ability of humans to understand metaphors, and that this impairment was greatest when the metaphors were unfamiliar to the participants (Hartwigsen & Siebner, 2012).

If a person learns two or more languages simultaneously as a child, Broca's and Wernicke's

areas are involved in the use of all languages. Interestingly, however, if an individual does not learn a second language (or third or fourth) until adulthood, the brain does not rely as heavily on Broca's and Wernicke's areas (Friederici, 2017). Instead, it recruits other circuits to aid in the learning process. Among these are parts of the prefrontal cortex, important for working memory, and the temporal lobe, which is active in the acquisition of semantic information. The recruitment of additional brain regions not involved in language learning early in life may contribute to the greater difficulty of learning a language later in life.

Reading also involves a wide range of brain regions. The physical actions required to read activate areas of the brain that aid in visual processing and motor functions. Since reading involves eye movements, for example, it recruits a brain region in the frontal lobe called the *frontal eye fields*. The content of what we read also affects which brain areas become more active during reading. Words of particular emotional importance, such as obscenities or disgust words, activate the amygdala. When we read words that evoke odours, such as *garlic* or *cinnamon*, the primary olfactory, or smell-related, regions of the brain become activated (González et al., 2006). This has led to a neuroscience of marketing that looks at how marketing images can be strategically selected to promote these sorts of sensory cross-connections called *embodied cognition* (Krishna, Lee, Li, & Schwarz, 2017).

Differences in Language Acquisition

There is considerable variability among the normal population in the rate at which language is acquired and the size of vocabulary and overall verbal skills. Some evidence suggests that males and females may differ in language skills. There are even differences in the number of languages that we acquire. Although all normal people become proficient in at least one language, some people are multilingual and can become fluent in many different languages.

Differences in Language Acquisition Among Individuals

Some of the variability in the rate of language acquisition is due to our environments. Our vocabulary size, for example, is affected by our environment, particularly early in life. For example, as described earlier in Practically Speaking 9.1, children in low-income households often hear fewer words and have smaller vocabularies when they start school than those from more affluent families (Fernald et al., 2012; Golinkoff et al., 2019).

There is also a great degree of variability in the normal population with regard to reading and writing skills. For instance, people differ substantially in the speed with which they can read. This skill seems to be tied to eye movements. In English, words are written on the page from left to right, and reading speed is greatest for individuals whose eyes move in the same left-to-right direction as the printed words, with no backtracking. Slower readers tend to not only pause for longer periods of time over individual words, but also to backtrack, moving their eyes back to words already passed (Schwab & Lew-Williams, 2016; Ashby, Yang, Evans, & Rayner, 2012; Jordan et al., 2016). It's not clear whether the less fluid eye movements occur because reading is more difficult, or whether the backtracking eye movements are a distraction that interferes with rapid reading.

Gender Differences in Language

One difference in verbal learning and overall skills that may be related, at least in part, to genetics is a notable gender difference in early language learning. Girls tend to learn to talk earlier, and on average, girls acquire speech and language comprehension at a faster rate than boys (see **Figure 9.5**) (Talbot, 2010; Bjorklund & Causey, 2017). These early differences often diminish by about age 2, however, when those boys slower to acquire language catch up.

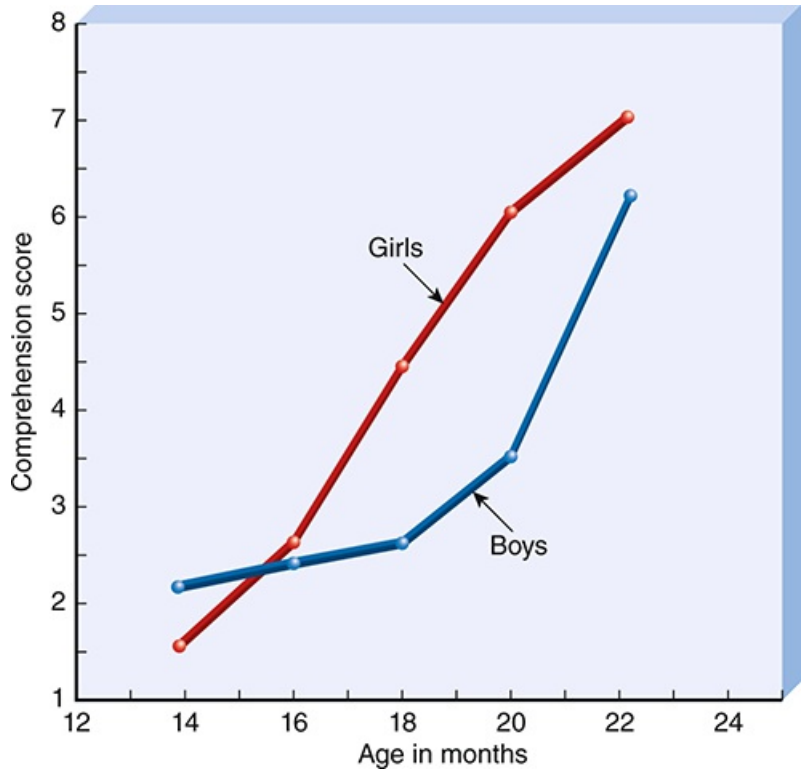


FIGURE 9.5 Gender differences in speech comprehension **Early on, there is a notable difference in language comprehension between girls and boys. Girls comprehend language at a faster rate, but this gender gap disappears by about age 2.**

Adapted from Reznick, J. S., and Goldfield, B. A. Rapid change in lexical development in comprehension and production. *Developmental Psychology*, 28, 406–413.

Chris Schmidt/iStockphoto

Gender differences Girls tend to outpace boys in language skills during elementary school.

Although boys may catch up in speaking skills, girls still seem to outpace boys in the language skills used in elementary school (see photo). As a group, girls score higher on tests of English ability, according to well-known Canadian researcher Doreen Kimura (2000), a professor at Simon Fraser University until her death in 2013. It's not clear, however, whether this difference is related to a real gender difference in language ability, or to a gender difference in some of the skills necessary to be a good student, such as paying attention, taking legible notes, and studying. By young adulthood, these differences are gone. There are no substantial male–female differences in overall critical reading or writing scores (Kimura, 2000, 2004; Mei et al., 2020).

When considering gender differences, remember to keep in mind that even though statistical differences may exist between average scores of boys and girls or men and women, these differences do not tell us anything about individuals. Many boys acquire language skills very rapidly and become talented writers and speakers as adults.

Another important point to consider is that the gender difference in language acquisition may have an experiential component. Because boys tend to be more active than girls, and girls tend to be more social than boys, it's possible that girls are exposed to a higher degree of interactive language than boys. If young boys are constantly on the move, exploring the environment may occupy more time than language learning.

Ryerson Clark/Getty Images

Language diversity **Many Canadians speak a second language, while many acquire three or more. Canadian children may acquire English, French, Inuktitut, Salishan, Michif, or any of the many other languages spoken in Canada.**

Despite the fact that there do not appear to be significant differences in overall verbal ability between adult men and women, some evidence suggests a difference in the way that women and men process language information. Neuroimaging studies have shown that, on average, women are more likely to use both hemispheres of the brain to process language information, whereas language processing in men tends to be more lateralized (Gur & Gur, 2017; Hirnstein, Hugdahl, & Hausmann, 2019). The extent to which these differences between men and women in recruitment of neural circuitry during language processing have any functional consequence remains to be determined. (See Indigenous Experiences 9.1.)

9.1 Indigenous Experiences

Indigenous Languages as "Dirty"

Historical trauma is associated with a series of disruptive events, resulting in collective losses and the erasure of culture, including the loss, or discrediting, of language (Kirmayer, Gone, & Moses, 2014). For 150 years, over 150,000 Indigenous children were forced to attend residential schools, where they were forbidden to speak their home languages. The Program of Studies, introduced in 1896, made speaking an Indigenous language a punishable offence in residential schools, and this policy remained for the life of the system (Joseph, 2018). Children arrived at schools unable to speak French or English, with teachers or supervisors who could not understand them, and who aggressively punished them for speaking the only languages they knew, by piercing their tongues with needles, locking them alone in closets or empty rooms overnight, strapping them, starving them, and other punishments. "These rules and the anxiety they caused remain among the most commonly cited elements of residential school experiences" (Truth and Reconciliation Commission of Canada, 2015, p. 50).

> One survivor said, "Even our own language was considered ugly; we weren't allowed to speak Cree language. I wasn't allowed to be myself as a Cree . . . everything was filthy . . . everything was ugly" (Name redacted, 2010, p. 56).
>
> Pierretter Benjamin reports being caught speaking her home language and being forced to eat soap. "They put a big chunk . . . and the principal, she put it in my mouth, and she said, 'Eat it, eat it,' . . . and she told me to swallow it . . . And at the end she told me, 'That's a dirty language, that's the devil that speaks in your mouth, so we had to wash it because it's dirty'" (Benjamin, 2013, p. 51).

When children went home, many were too traumatized from the punishments they had received to speak their home language and eventually they lost the ability to speak or understand it. Their parents often spoke no English or French and as a consequence lost the ability to communicate with their children. This happened to John Kistabish. He reports that when he left school, he spoke only French and his parents spoke only Algonquin, leaving him unable to communicate with them about the abuse he suffered. "I had tried to talk with my parents, and, no, it didn't work . . . I knew that they were my parents, when I left the residential school, but the communication wasn't there" (Kistabish, 2013). Conversely, many parents, those who had themselves attended residential schools, taught their children only French or English, to save them from future suffering.

There were some exceptions. Mary Stoney said, "We were lucky to have Father Mullen, who helped preserve our Cree language by translating the Bible and hymns. If not, the language would be in worse shape" (Stoney, 2013). Others resisted, secretly speaking together in their home languages, sometimes teaching it to younger children. Monique Papatie said, "We kept our language, the Anishinabemowin language, and I speak it very well today, and this is what I want to teach the children, my mother's grandchildren and great-grandchildren" (Papatie, 2012).

sylv1rob1/Shutterstock.com

There is an intrinsic link between culture and language **Children learn about the distinct aspects of their culture and its practices through its language.**

The result of these ruthless policies has been to threaten all but three Indigenous languages (Cree, Anishinabemowin (Ojibwa), and Inuktitut). In 1996, the United

Nations Educational, Scientific, and Cultural Organization (UNESCO) identified two-thirds of Canadian Indigenous languages as endangered or vulnerable, placing cultures at risk (Joseph, 2018). This loss of a spoken language represents more than simply the loss of a language. "In oral societies, when the words are gone, so are the histories, the value systems, the spiritual, ecological knowledge, the worldviews, the stories and the songs. It is an irreplaceable loss. The loss of a language severs the connection between people and their culture" (Joseph, 2018, p. 67).

Critical Thinking Questions

What are some of the most powerful differences between students' residential school language experiences and second language learning more generally?

What were the consequences of residential school language experiences for students once they returned home?

Beyond communication, if language is how we map meaning onto the world, what were the consequences of the systematic efforts in residential schools to stop students speaking their own languages?

Learning More Than One Language

Many children grow up in multilingual homes, where two or more languages are spoken (see photo). Such children tend to learn to speak and understand language at slightly later ages than children who only need to learn a single language (Butler, 2013). The greater amount of information and decoding necessary to learn two or more languages simultaneously may explain the very slight lag.

Like first languages, multiple languages are also most readily acquired by the very young. In adulthood, the language learning process is labour intensive and often remains incomplete. By the age of 13, our language learning ability has declined substantially (see **Figure 9.6**) (Birdsong & Molis, 2001; Birdsong & Vanhove, 2016). The difference can be seen with accents. People who learn to speak English as a second language as children speak it without an accent, whereas those who learn it as teens or adults speak English less fluidly and typically with the accent of their native tongue. A similar phenomenon exists for deaf children learning sign language. After about age 13, it becomes more difficult to learn this skill (Mayberry, 2010; Birdsong & Vanhove, 2016). Recent research that looked more closely at the age of onset of exposure to a second language in more than 600,000 second language learners has suggested that while the shape of the curve in **Figure 9.6** is correct, the steep drop in second language leaning proficiency may not start to tail off until around 17 years of age (Hartshorne, Tenenbaum, & Pinker, 2018).

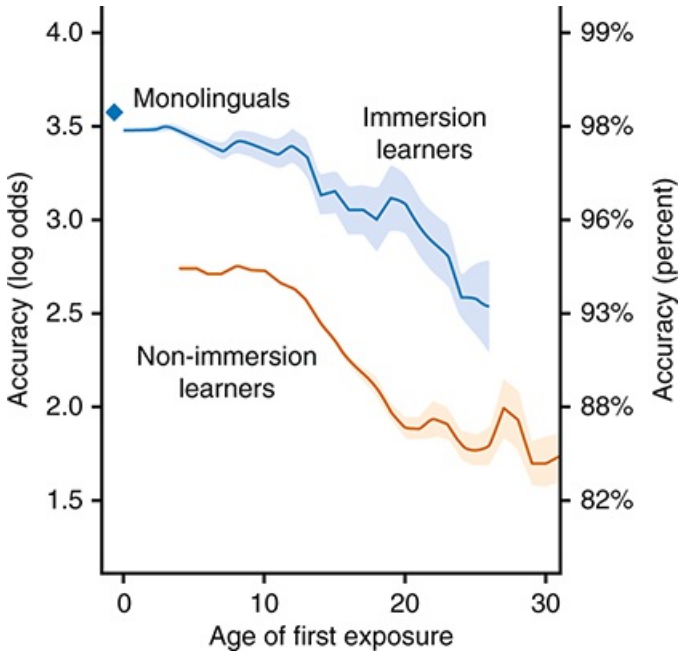


FIGURE 9.6 Immigrants' English proficiency by age of arrival **Immigrants' mastery of English depends on when they begin the learning process. The proficiency of those adults who started learning their new language before age 7 is comparable to that of native speakers. However, the proficiency of those who started acquiring the language in young adulthood is much poorer.**

Reprinted from *Cognitive Psychology*, 21, J.S. Johnson & E.L. Newport, Critical period effects in second language learning: The influence of maturational state on the acquisition of English as a second language, pp. 60–99, Copyright 1989, with permission from Elsevier.

Knowing this, many of us wish we had been exposed to multiple languages as youngsters. Those fortunate enough to have this experience can become fluent in several languages without any formal study. See for of the payoffs of learning a secind language, beyond just having a second language, see Positive Psychology 9.1 to see how second language learning is managed in the brain look through Your Brain and Behaviour 9.1.

9.1 Psychology Around Us | Positive Psychology

Positive Psychology Strategies for Second Language Learning

Becoming fluent in more than one language is good for your brain. Learning a second language may also provide social and economic benefits. For example, in today's globalized economy, fluency in a second language can help you land that dream job, while being able to travel to another country or region and converse in the local language can be liberating and heighten the experience. Fortunately, in today's web-based world there are many language apps that allow users to learn a language at their own pace and even interact with native speakers.

In many parts of the world, being bilingual or a polyglot is the norm rather than the

exception. Indeed, in countries like Singapore, the Netherlands, and Switzerland, each with four official languages, the proportion of the population who are at least conversant in multiple languages is much higher than in North America. In Canada, about 20 percent of the population is bilingual, whereas in Germany that number is closer to 70 percent. Learning a second language is not without stress, however, and this is where the positive psychology movement has become a key player in second language acquisition (SLA).

Using positive psychology exercises as part of SLA, such as using your second language to write or speak about gratitude or describe a positive experience in your life, can bring additional joy and meaning to challenges of learning a second language (Gregersen, MacIntyre, & Meza, 2016; MacIntyre & Mercer, 2014). Using positive emotional states and imagining a positive future self speaking a second language can facilitate building cognitive resources to master and absorb a new language and develop a deeper appreciation for the culture(s) associated with the language (McIntyre & Gregersen, 2012). The use of positive psychological techniques to assist Individuals in SLA is an exciting new research and applied area of psychology that is only beginning to be explored.

9.1 Your Brain and Behaviour

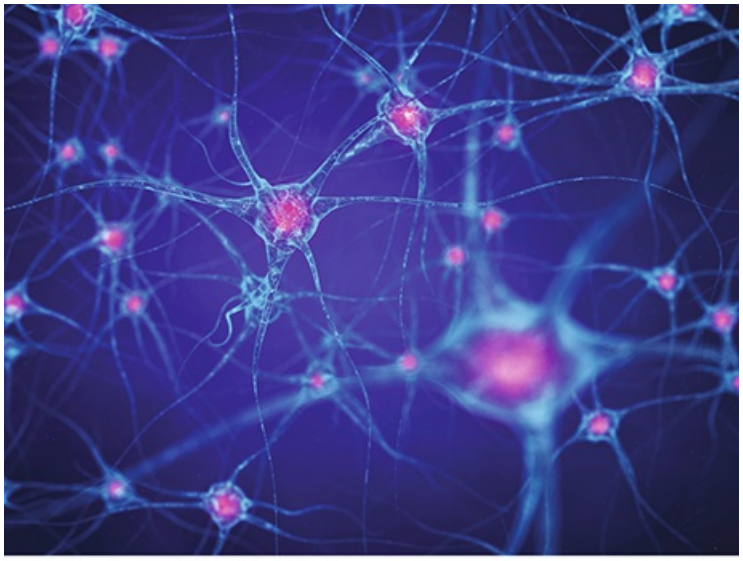
Learning a Second Language

Do you speak more than one language, or are you learning a second language now? What if someone were to ask you for directions and it was clear you needed your second language to communicate with them? What parts of your brain were used when you learned a second language and what parts are being called into play as you use it to give directions? Learning a second language not only engages brain regions that are involved in language prodution and comprehension, it also activates areas important for learning semantic information, such as the hippocampus, and those important for working memory, such as the prefrontal cortex (Berwick et al., 2013). As we acquire grammatical rules and become more fluent, the regions in our brain associated with learning a first language—such as Broca's area and Wernicke's area—become primarily involved. As we activate these language production and comprehension areas more and more, we rely less and less on semantic and working memory regions.

On a purely structural basis, studies have shown that learning a second language increases neuroplasticity, regardless of the age of the person learning (Li, Legault & Litcofsky, 2014). Benefits include increased grey matter, increased grey matter density, and improved white matter integrity. These structural brain changes don't take years; learning a second language for even a few months improves these metrics measurably. Further, studies show that bilingual individuals consistently outperform single-language individuals on tasks requiring executive control (Bialystok, 2011).

For those who are worried about losing cognitive function as they age, perhaps the greatest benefit of learning a second language is shown in studies that found that

second language learning can delay the onset of cognitive decline (Alladi, 2013). In one study in India, fluency in at least two languages delayed the onset of dementia by an average of 4.5 years. Clearly, learning a second language has social, economic, and cognitive benefits that go beyond merely being able to say that you speak more than one language.



nobeastsofierce/Adobe Stock Photos

Second Language and Grey Matter Density **Increasing grey matter with a second language means adding new connections between neurons like those in this photo.**

Questions

How do patterns of brain activity change as we become more fluent in a second language?

Which part of the brain is most active when we switch from using our first language to using a second language?

Is a person who achieves fluency in a second language likely to show the exact same patterns of brain activation while using his or her first language versus the second language? Explain.

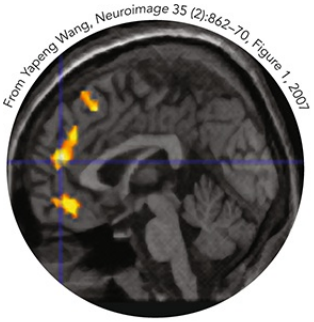
What advantages does second language learning hold for us as we age?

Photo by Cristian Newman on Unsplash

Staying Mentally Fit **Learning a second language as we age can prevent the onset of cognitive decline.**

Source: geralt/Pixabay

Neuroplasticity **Even a few months of studying and attempting to learn a new language can lead to brain changes and may even enhance a person's executive control abilities.**



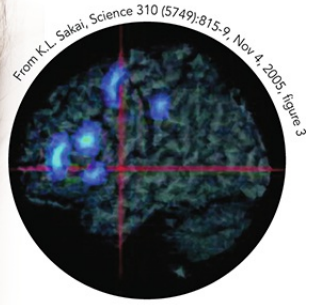
From Yapeng Wang, Neuroimage 35 (2):862–70, Figure 1, 2007

Switching from one language to the other Once you have learned a second language, switching from your first language to the second one involves the prefrontal cortex, as shown here in this fMRI image (yellow areas). Switching from your second language back to your native tongue doesn't require the use of these brain areas, probably because it takes less effort.

Becoming fluent As we become fluent in a second language, the brain becomes less active, as shown on these brain scans of someone new to a second language (intense red areas, top image) versus someone with years of second language experience (lighter red areas, bottom image). So, better performance means less brain activity.

From K.L. Sakai, Science 310 (5749):815-9, Nov 4, 2005, figure 3

RuslanDashinsky/iStockphoto



From K.L. Sakai, Science 310 (5749):815-9, Nov 4, 2005, figure 3

Being bilingual But even when we reach the same level of proficiency in a second language as with a first language, the second language requires more brain activation, shown here (blue areas) in this fMRI image.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

1. What is language and how does language production differ from language

comprehension?

2. What are phonology, morphology, syntax, and pragmatics?

3. What is the typical sequence of language acquisition for most babies?

4. Where are Broca's and Wernicke's areas located in the brain? What is the primary function of each of these areas?

What Do You Think? • Should preschools and early grades of elementary schools in Canada be required to teach children multiple languages? What might be the advantages and drawbacks for children of such schooling?

The Relationship Between Language and Thought

LEARNING OBJECTIVE 2

Describe how thought and language are related and summarize the linguistic relativity hypothesis.

Many of us consider our thoughts to be primarily related to language. Since we often have no trouble responding automatically with words in a conversation, it can seem that language is the natural driving force of thought. One influential psychological theory suggests that our language controls and limits our thoughts. In many cases, however, complex thoughts occur in the absence of language. So what is the relationship between thought and language? Is language simply a tool for expressing our thoughts? Or are our thoughts a consequence of the language we learn and the things we are told about the world using our native language? We will consider a few of the areas of investigation related to this question of the relationship between thought and language. You will see that the answers are not simple and not yet complete.

Thinking Without Words: Mental Imagery and Spatial Navigation

During the weeks before spring break (except in 2020), you may enjoy picturing yourself lying in a hammock sipping a cool drink while overlooking the coast of Cuba, or skiing down the slopes of the Rocky Mountains in Banff National Park. **Mental imagery** refers to thoughts that involve conjuring internal visual representations of stored sensory input. Most of our mental imagery does not involve language (Finke, 1989; Gregory, 2018a, 2018b).

mental imagery picturing things in your mind.

Another good example where language doesn't play a major role in thinking can be observed with spatial navigation thinking (see Psychology Around Us 9.1). Although some people use narrative to remember directions, such as, "Turn right at the second light on Main Street," in many cases, spatial thinking occurs in the form of visual imagery. You may remember the appearance of certain street corners and automatically turn right when you

are triggered to do so by your visual system. Some people use dead reckoning or a "sense of direction" to navigate. This kind of directional skill—knowing that a certain direction is north, for example—is not language driven.

Our ability to use imagery to solve problems is often based closely on our spatial memories. Studies have shown that we appear to search our actual relevant memories to solve tasks requiring mental imagery. For example, if researchers give participants photos of rooms that are long and narrow with regularly-spaced objects in them, and later ask the participants to describe the objects located in those rooms, the participants do so with a greater lag time between objects than if asked to carry out a similar task after looking at a photo of a smaller room (Kosslyn & Shin, 1991).

9.1 Psychology Around Us

Driving on Autopilot

For most people, spatial navigation becomes almost automatic, especially when this navigation is part of their routine. Consider as an example a daily commute to work or school. You may climb into the car, turn on the engine, and later find yourself at your destination without recalling the details of the drive. In fact, some people become so lost in their thoughts while driving that they forget if they planned to go somewhere different or unusual at the end of the day. You may arrive at your house before even realizing that you had intended to go to the store on your way home, for example (Charlton & Starkey, 2011). What is going to be very interesting is to see how human autopilot moments interact with actual autopilot systems being built into new cars like Teslas. This is definitely an emerging research area to watch (Brown & Laurier, 2017; Dikmen & Burns, 2016).

Interestingly, using mental imagery activates many of the same brain regions used for the sensory experience itself. Neuroimaging technology has allowed us to observe which regions of the brain become most active when people think. This type of research suggests that thinking about something can actually activate the same brain regions as sensing or doing it (Goldberg, Perfetti, & Schneider, 2006). There are many examples:

> When you visualize or picture in your mind an event or scene, your brain activates the visual areas that would be active if you were actually gazing at the event or scene (Pearson, 2019).
>
> Thinking about tastes and odours activates many of the same gustatory and olfactory brain regions involved when you really do taste or smell something (Spence, 2016).
>
> Thinking about fear- and anxiety-provoking subjects activates the amygdala, an area involved in anger, fear, and stress (LeDoux, 2015).

And when we do have thoughts that involve language, they activate the frontal and temporal lobes, the same areas used when we comprehend or produce spoken language (Goldberg et al., 2006).

Although some of our thinking involves mental imagery, it is obviously not sufficient for all

of the complicated thoughts humans have. There are many concepts that do not have an adequate mental image. Consider thinking about love. Some symbols of love, such as a heart or Cupid with his arrow, are associated with love, but they hardly tell the whole story. Even conjuring mental images of our loved ones doesn't adequately express our thoughts about love in general. As we will discuss in the rest of the chapter, much of our thinking involves the use of words, often in combination with imagery.

The Influence of Language on Thought

Many psychologists believe that language greatly influences our thinking. This older theory about the relationship between thought and language is called the **linguistic relativity hypothesis**. The linguistic relativity hypothesis was advanced by Edward Sapir and Benjamin Lee Whorf (Sapir, 1921; Whorf, 1940, 1956) and suggests that the more words we have available to us related to a single concept, the more complex and detailed our thoughts are about that object or idea.

> **linguistic relativity hypothesis** hypothesis suggesting that the vocabulary available for objects or concepts in a language influences how speakers of that language think about them.

Evidence in support of the linguistic relativity hypothesis comes from cross-cultural studies that reveal large discrepancies in the number of words various languages dedicate to certain characteristics or objects. Studies have shown that extensive vocabularies for certain characteristics can lead to an ability to make finer distinctions along that dimension (Webster & Kay, 2012; Casasanto, 2016). The English language, for example, has many words used to distinguish different colours. We can describe nuances of difference in shades of the colour blue, for example, by using words such as *azure*, *cobalt*, *cyan*, *indigo*, *turquoise*, *aquamarine*, and more. By contrast, members of the Dani tribe of Papua New Guinea have in their entire language only two words to distinguish colour, one word for light and the other for dark. Importantly, these people are not colour-blind (see photo). They can perceive differences in colour, but they do not have words to describe them (Heider, 1972). So having fewer words for things like colour does not actually limit the Danis' ability to see colour, just their ability to talk specifically about what they see.

Interfoto/Alamy Stock Photo

Far from colour-blind **The colourful and carefully blended war decorations of Dani tribesmen show that these individuals from Papua New Guinea are not colour-blind, despite their limited vocabulary for colours.**

The linguistic relativity hypothesis, as it is currently understood, suggests that because English-speaking people have words for subtle concepts or distinctions regarding colour, we are encouraged to think more about them than we would if, like the Dani, our vocabulary did not include those words. Nevertheless the number of colour words we possess does not impact our visual perception or our thoughts about the colours we can see. So the strong version of the linguistic relativity hypothesis is not supported—but are there ways in which language shapes thought? More recent research suggests that there are. For example, the ways Inuit speak of snow contain distinctions that are important to adaptation to an arctic climate (Tohidian, 2009).

We learn about the world partly through our personal experiences. We also learn about the world by being told about it. Many of the concepts we learn as we develop have been put together and managed within the particular socio-cultural perspective of the community in which we live. If our cultural community maps a particular concept in a particular way, then that is how we will learn that concept. Therefore the difficulty children experience when acquiring concepts depends on the way the concept is structured in the local cultural community. Think about the concept of *living things*. What sorts of things are living things? In English we make several distinctions within the concept of living things (see **Figure 9.7**). English speakers first distinguish between plants and animals, but then sometimes further divide animals into human and non-human animals. The rules about when it is appropriate or insulting to refer to another person as an animal are hard to learn. For example, English-speaking children need to learn which of the following is insulting: "You are such a pig," versus "You sing like a bird." In contrast, in Indonesia living things are conceptually divided into three categories: humans, animals, and plants. With no guesswork, this structure is easier to manage and therefore Indonesian children can properly understand and master

the concept of living things at an earlier age than children speaking English can (Medin, 2015). The simpler language structure for the concepts makes it easier to acquire developmentally.

Another example of the way that language can shape thought starts with what the comedian Steve Martin once said: "Boy, those French have a different word for everything!" While of course that is true, as we have just seen, the linguistic relativism theory suggested that our words actually map out the world differently. The relationship between thought and language, however, goes both ways. Even if a culture has many words for snow (the linguistic relativity hypothesis), it is possible to explain the differences so that those without specific words for different types of snow can still understand the differences (Regier, Carstensen, & Kemp, 2016).

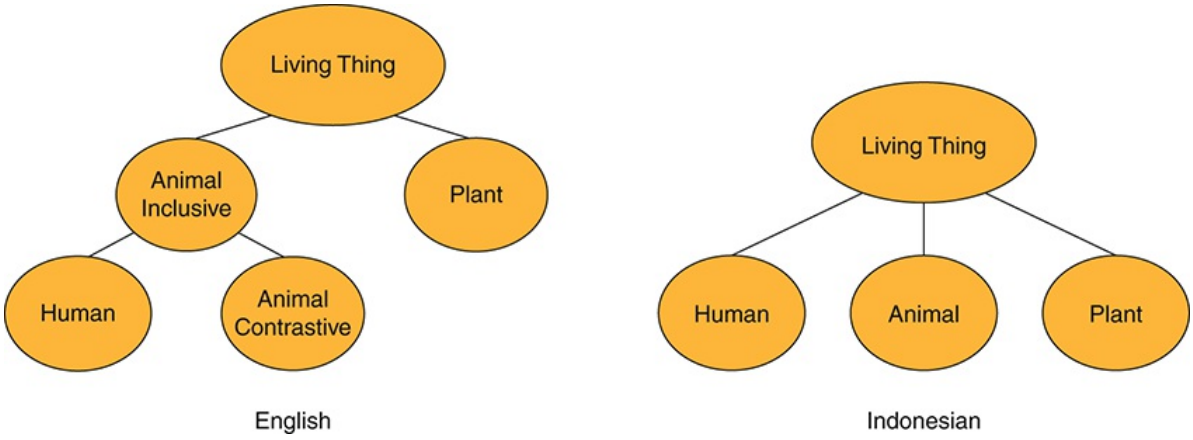


FIGURE 9.7 Cultural conceptions of living things In English we make a subordinate distinction beneath our concept of animals to distinguish humans from animals, whereas in Indonesia the distinction is simple, handled at the first basic level.

On the other hand, having a very specific word for a complex social situation suggests a clearer understanding of the situation. Howard Rheingold (2000) set out to collect words from various languages that concisely capture specific social situations. For example, the Mayan term "bol" means something like "stupid in-laws" in English, whereas the German term "Treppenwitz" means something like "clever remark that comes to mind when it is too late to use it," and the Japanese term "kyoikumama" means something like "mother who pushes her child to academic achievement," and, last, our favourite, "Korinthenkacker" is a German word that literally translates to "raisin-sh*tter" and refers to "a person overly concerned with trivial details."

So the ways that our socio-cultural communities divide up the world and our experiences lead to the emergence of new concepts, words, or phrases that are used in language to communicate our shared observations. Through those communications, we not only acquire a language, but also a way of thinking about the world.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

5. What is mental imagery? What parts of the brain does mental imagery involve?

6. What research evidence suggests that we use mental imagery to solve problems involving our spatial memories?

7. What does the linguistic relativity hypothesis suggest about the influence of our language on our thinking and what research has been done? What are some more recent examples of this type of influence?

What Do You Think? • In what ways do you believe your language influences your thoughts?

Thought

LEARNING OBJECTIVE 3

Describe and summarize research on thinking processes, including problem solving, decision making, and metacognition.

We can think in many different ways. The study of cognition includes, for example, mental imagery and spatial navigation, as we have seen. Cognitive scientists also study the development of our thinking abilities, how we solve problems, how we make decisions, and even how we think about our own thoughts. We will take a look at some of their major findings in the remainder of this chapter. Our thinking abilities are truly impressive, but the variety and complexity of thought also means we are sometimes vulnerable to problems in our thinking. We'll also discuss two psychological disorders that are characterized primarily by disruptions in thought processes.

Different forms of thinking develop at different rates. Thoughts that involve language emerge around the time that language capabilities are forming, whereas those that involve reasoning emerge later. Michael Chandler, now deceased but then working at UBC, and Jeremy Carpendale at Simon Fraser University (1998; Carpendale, Lewis, & Muller, 2017) argue that skills requiring self-awareness, such as formulating or changing long-term plans and carrying them out, require a type of thought that develops relatively late in children—not until around the time of school entrance (see photo). Changes in our thinking continue to occur throughout life. Teenagers and young adults become increasingly capable of making and carrying out long-term plans for their futures.

Thinking and Effort: Controlled and Automatic Processing

The distinction between controlled and automatic thinking is an important concept in cognitive psychology (Kahneman, 2012). As we discussed in Chapter 8 on memory, *controlled processing* is effortful and relies on a limited-capacity system, while *automatic processing* seems effortless. Automatic processing is not usually disrupted very much if we are distracted by other tasks. Experienced drivers can carry on a conversation with a passenger while driving a car, for example. However, automatic processing, such as driving,

can be severely disrupted by simultaneously engaging in a task that requires more attention than speaking, such as reading or sending a text message (see photos). Controlled processing requires more attention. Most of us cannot carry on a conversation while conducting multi-digit mental arithmetic; we must direct our thoughts toward the math problem. Driving performance suffers more if the cell conversation one is having (even using a hands-free system) is intense or complicated and thus more demanding of cognitive attention (Qu, Zhang, & Zhang, 2014; Lansdown & Stephens, 2013).

Vanessa Davies/Getty Images

That's me! Complex self-awareness arrives around the time children enter school, several years after they have become able to recognize themselves in a mirror at 18 months to 2 years of age.

Cognitive control refers to the ability to direct thought and action in accord with one's intentions (Marek & Dosenbach, 2019; Amer, Campbell, & Hasher, 2016). Some examples of this include:

- the ability to direct attention to a specific stimulus within other competing, and perhaps stronger, stimuli, such as finding the face you are looking for within a crowd
- maintaining a new piece of information in mind despite distraction, such as remembering a telephone number until you dial while on your cellphone in a crowded

mall

overcoming a compelling behaviour, such as not scratching a very itchy mosquito bite

pursuing a complex but unfamiliar behaviour, such as learning the moves of a new sport or how to work the controls of a new videogame

responding flexibly and productively in new situations, such as playing a complex videogame that requires anticipating future consequences

cognitive control the ability to direct thought in accord with one's intentions.

Hero Images/Getty Images

Rostislav_Sedlacek/Shutterstock.com

Automatic processing has its limits **Even automatic processing, such as that used when driving a car, can be severely interrupted by tasks that require significant attention, such as texting. Thus, to prevent car accidents, provincial laws typically allow people to converse (a relatively non-distracting activity) on a hands-free phone while driving, but forbid them to use a hand-held cellphone. Unfortunately, hands-free cellphone use is also distracting, possibly to the same extent as hand-held use (Yan et al., 2018) and the level of distraction varies depending on the intensity of the conversation one is having (Lansdown & Stephens, 2013).**

The brain's ability to exert control over mental processing is referred to as **executive function**. People with damage to the frontal lobes often display a condition called **dysexecutive syndrome**, characterized by impairments in cognitive functions that depend on control, such as planning or the ability to flexibly respond in new situations.

executive function the brain's ability to control and manage the mental processing of information.

dysexecutive syndrome impairments in the ability to control and direct mental activities.

This deficit was dramatically documented in the classic case of Phineas Gage. As we discussed in Chapter 3, Gage was a railroad foreman who suffered damage to his prefrontal cortex when a metal spike was driven through his head in a construction accident. Before the accident, acquaintances described him as thoughtful, responsible, and of sound judgment, but following his injury, he was considered to be "capricious . . . and unable to

settle on any of the plans he devised for future action" (Harlow, 1868). Changes such as these have been observed repeatedly in patients with damage to the frontal cortex.

szefei/iStockphoto

Enough for everyone **By the age of 6 to 8 years, children have learned to better control their thoughts and actions in accord with their various intentions. Sharing everything from ice cream to toys becomes a more common occurrence.**

As we age, we also develop more capacity for cognitive control. Very young children, for example, often make decisions based on impulse; if they want the cookie and it's in view, they will grab it. For this reason, problems arise with social interactions. Preschool-aged children will often fight over toys because they don't understand the concepts of waiting and fairness. As children grow, however, their decision-making process becomes more sophisticated. Usually by the time they are 6 to 8 years old, children are able to manage their impulses for the good of their interaction with their peers (see photo). During snacktime, William may save a cookie for Lydia, who is out of the room, rather than eat it himself. At an even later stage, between the ages of 9 and 12 years, children become able to make decisions with the long-term future in mind. They are more willing to make sacrifices in the immediate future to get a larger payoff later on. If given the option of getting one square of chocolate after completing a single math problem or an entire chocolate bar after a 24-hour waiting period, older children will often decide to hold out for the whole bar (Mischel, Shoda, & Rodriguez, 1989). The frontal lobes of the brain, believed to be important for cognitive control, are not fully developed until the late teens or early 20s (Giedd et al., 2015).

Thinking to Solve Problems

One aspect of thinking that has received considerable attention from psychologists is that of problem solving. **Problem solving** is triggered by our desire to reach a goal. We must figure out how to get from our current state of affairs, which is in some way unsatisfactory, to our desired end state (Bourne, Dominowski, & Loftus, 1979; Güss, 2019). We use problem-solving skills in many avenues of life, from the formal mathematics problems we have all solved in school, to informal day-to-day problems, such as how to get along with a

roommate.

problem solving determining how to reach a goal.

Defining Our Problems

The first step in solving a problem is to figure out exactly what your problem is—to develop a representation of the problem.

On one end of the spectrum, we use formal problem-solving skills to solve math problems. Our goal in arithmetic is usually straightforward: to move from not knowing the correct answer to knowing it. Researchers refer to problems with easy-to-discern beginning and end states, such as arithmetic, as *well-defined problems*. We often find it fairly easy to find a strategy for solving well-defined problems because we can easily define what outcome we want from the start (Funke, 2019).

On the other end of the problem-solving spectrum are *ill-defined problems*, such as how to deal with a messy roommate. Our goal in this case might be difficult to define in precise terms. We may want to stop doing what we feel is an unfair share of housecleaning, but how will we know when we have reached that goal? As you might imagine, it's often more difficult to find solution strategies for ill-defined problems than it is for well-defined ones, because it is hard to define the desired outcome (Chevallier, 2016).

To define a problem, you must figure out your current state and your goal, and identify the differences between them. Consider the following problem. When driving home on a particular road, you need to make a left onto Main Street at a traffic light that is always very backed up at the time of day you travel. Your current state is frustration with the long wait at the light.

Your goal might be to find a faster way to make the turn. With this goal in mind, you could consider several ways to speed up the turn, such as altering the time of day you travel, driving faster to arrive at the intersection earlier, or merging into the line of waiting cars closer to the intersection. None of these solutions is ideal. If the problem is represented in a different way, however, a new solution may come to mind (Schwarzer, 2014). You might, for example, change your question from, "How do I make a left onto Main Street?" to, "How can I get onto Main Street faster?"

Adopting a new goal such as this may cause you to notice that you could turn right into the parking lot of a shopping centre at the corner, then exit the lot quickly and legally onto Main Street in the direction you want to go—avoiding the left-hand turn entirely. Changing the representation of a problem doesn't guarantee you will find a solution, but it increases your chances of finding one if your new representation triggers you to consider new alternatives.

Strategies for Problem Solving

After you have represented the problem, you must choose a strategy for finding a solution. Two major types of strategies—algorithms and heuristics—are used. An **algorithm** is a strategy that, if followed methodically, will always lead to a solution. For example, an algorithm strategy could be used to solve an arithmetic problem that includes adding up a

series of 10 single-digit numbers by adding each number to the overall sum. Following this algorithm will produce a correct answer, but it can be time consuming. If you had to add up the total of 50 or 100 different numbers, you might begin to look for faster ways to solve the problem.

algorithm a problem-solving strategy that always leads to a solution.

To save time and effort when solving problems, we often use a set of **heuristics**, or shortcut strategies. Instead of taking the time to add together a long list of numbers, you might just estimate the total. Heuristics often help us reach a satisfactory solution, but they do not guarantee a correct answer to a problem (Funke, 2019).

heuristic a shortcut thinking strategy.

Milton Brown/Getty Images

Two heads are better than one **For many problems, better solutions are reached when multiple persons think the problem through together. Such collaborations may increase the likelihood of gathering sufficient information and reduce the chance of falling into common problem-solving traps.**

You can use algorithm and heuristic strategies to solve problems in everyday life. Consider the steps you would take to find out whether or not a particular professor will be a good teacher for you before enrolling in his course. Using an algorithm method, you might question every student enrolled in the class the previous term. This method would give you the maximum amount of information and the greatest chance of reaching the correct answer. Using a heuristic strategy, you might ask a few students you know who took the course or examine the drop rate in the class for evidence of how many students decide against the course once enrolled. Heuristic methods save time and effort, but they are also riskier. Your few acquaintances might not learn as well from a teaching style that you like, for example. On the other hand they might suggest some factors you have not considered, allowing you to make a better decision (see photo).

Some helpful heuristic strategies in problem solving include working backwards, forming subgoals, and searching for analogies.

Working backwards is helpful for problems with well-defined goals. Starting from your goal, you think backwards, imagining a series of steps it would take you to move backwards from your goal to your current state. Once you have determined the steps between your current state and the goal, you can actually follow them in a forward order. A working backwards example is the water lily problem. Imagine that you have planted a water lily on a pond. The number of leaves the lily produces on the water's surface doubles every day. On the 30th day, the number of leaves will cover the pond and kill off all the living things in the pond. You decide to cut out the lily when it has covered half the pond. What do you need to know to work out when to cut the lily (e.g., size of the pond, size of the lily leaves, etc.)? The answer? You need to know nothing if you work backwards, as you will cut the lily on the 29th day (before its coverage doubles one more time and covers the whole pond).

Forming subgoals involves dividing a larger problem into smaller ones (Catrambone, 1998; Margulieux & Catrambone, 2016). If your ultimate goal is to find out if a professor will be a good teacher for you, you may form subgoals, such as asking three former students about the professor and arranging to sit in on a lecture. Another example that is a bit more specific is called the tower of Hanoi problem. Four disks of different diameters are stacked from largest up to smallest on the leftmost of three pegs. Your task is to shift the whole stack to the peg on the far right, but only by moving one disk at a time and by never having a larger disk set on top of a smaller disk. You can see an animated solution to this problem at the following link: www.mathsisfun.com/games/towerofhanoi-flash.html. Note that the solution involves accomplishing a series of subgoals.

Searching for analogies involves recalling similar problems that you have encountered (Holyoak, 2012; Gentner & Maravilla, 2017). Imagine you are driving a car borrowed from a friend and it breaks down. You may not have much experience figuring out what is wrong with cars but, if you have worked on motorcycles in the past, there may be some experiences that you can draw on analogously to try to figure out what is wrong with the car. Alternatively, you might remember calling your university's information technologies help desk to get help solving a computer problem, and come up with the idea of calling a relative or friend who has expertise with car repair.

	A	B	C	Goal
1	21	127	3	100
2	36	151	9	97
3	11	76	5	55
4	2	16	2	10
5	15	39	3	18

FIGURE 9.8 The water jar problem Start at the top row (line number 1). Imagine that you have three containers (A, B, and C) that hold the number of units of water indicated across row #1. Using only those containers and no other measuring

device, figure out how to end up with the goal amount of water listed in the last column of the table for that row. When you have a solution, move down to the next row and solve that problem as well. Keep moving down until you have solved all rows. Now show this problem to a friend, but have her begin with the bottom row and move up to the top row. Notice any differences? Check at the end of the chapter to see what the original study found by following this same procedure.

We are not always aware of using a method to solve a problem. Sometimes we seem to solve a problem quickly, without intensive effort or concentration, through a phenomenon known as *insight*. In fact, several groundbreaking scientific discoveries have been described as "eureka" moments of insight. George de Mestral took his dog for a walk in the woods and when he returned home, George noticed his pants were covered in burrs that were hard to remove. Curious, he looked at one under a microscope and saw the small hooks at the ends of the burr spines. He thought about it and, eureka, Velcro was invented (Freeman & Golden, 1997). Sometimes sudden solutions occur after an *incubation period* during which we have mentally "set aside" a problem that we've been working on. When we return to the problem after a period of time, the solution comes to mind without further conscious strategizing. Some studies suggest this type of problem solving is automatic (Bassok & Novick, 2012; Sio & Ormerod, 2009).

Problems in Problem Solving

Sometimes we fall into patterns of thinking that make it difficult to solve problems to which those patterns don't apply. One common difficulty can happen early in representing the problem. We must define the problem using relevant information and ignore any irrelevant information. When deciding what movie to go and see, you might make your decision based on the number of times you have seen trailers of a movie, rather than looking at reviews or asking friends who may have seen it already. In fact, the number of trailers released may be a function of studio concerns about the quality of the movie.

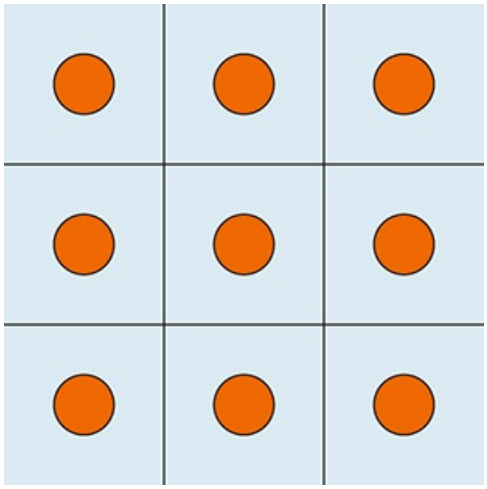


FIGURE 9.9 The nine-dot problem Without lifting your pencil, draw no more than four straight lines to connect all the dots. (The solution is at the end of the chapter. See Figure 9.11.)

Other difficulties can occur when we get to the point of actually solving problems. Some of

these are the result of heuristics. When we use the heuristic of looking for analogies, for example, we risk falling into a **mental set**, a tendency to use problem-solving strategies that have always worked in the past. If you have a certain solution in mind, you may see the problem as fitting that solution, when it does not. If you view getting onto Main Street with a mental set that sees the problem as how to make a left turn, you miss possible solutions that do not involve left turns (like making three right turns). The water jar problem shown in **Figure 9.8** and the nine-dot problem shown in **Figure 9.9** are good ways to practise overcoming mental sets (Gilhooly, 2015). **Figure 9.11** at the end of the chapter provides the solution to the problem shown in Figure 9.9.

mental set tendency to use problem-solving strategies that have worked in the past.

FIGURE 9.10 The string problem **Two strings are suspended from above, and you cannot reach both of them at the same time. How can you tie them together? (The solution is at the end of the chapter. See Figure 9.12.)**

One particular version of a mental set is referred to as **functional fixedness**, the tendency to view objects as having only one use or function. If you have ever used a coin to turn the head of a screw when you didn't have a screwdriver handy, you have overcome functional fixedness. The string problem, shown in **Figure 9.10**, is one test that psychologists have used to reveal when people are experiencing functional fixedness. **Figure 9.12** at the end of the chapter provides the solution to the problem shown in Figure 9.10.

functional fixedness tendency to view objects as having only one function.

We can also hamper our ability to solve problems by adopting a **confirmation bias**, a tendency to look for information that meets our expectations when solving problems (Duncan & Russo, 2016). If you have heard that all of the professors in the department in which you are thinking of taking a class are good teachers, you may only seek out opinions from students who completed the class taught by the professor whose class you are thinking of taking, rather than undertaking the more difficult task of finding people who have dropped the course. The problem with this approach is that students who stayed through the whole course would be more likely to confirm what you expect to hear, that the teacher is good, than to give you a negative, but potentially helpful, evaluation.

confirmation bias tendency to look for information that meets our expectations.

In one classic study, researchers revealed confirmation bias by giving participants a series of numbers: 2, 4, and 6 (Wason, 1960; Evans, 2020). They asked the participants to figure out the rule for that set by generating their own sets of numbers. Each time the participants offered a series, the experimenters told them only whether their set did or did not follow the same rule as the original set. Many participants became convinced that the rule was to increase each number by 2. They offered repeated sets of numbers, such as 8, 10, 12 or 24, 22, 20. The researchers told them that their sets conformed to the original rule, but when asked to state the original rule, these participants got it wrong. The original rule was simply that each number had to have a numerical value larger than the one before it. The numbers the participants generated themselves conformed to the rules they created, but it didn't occur to them that other rules were possible.

The way to overcome confirmation bias is to purposely look for information that disconfirms your ideas. Participants who generated random series of numbers, such as 54, 3, 12, would have been more likely to correctly figure out the rule.

Thinking to Make Decisions

Decision making involves evaluating and choosing from among the alternatives available to us. Many of your everyday thoughts involve weighing options and making choices. First you must decide what time to wake up. A series of decisions follow, including choices about what to wear, what to eat for breakfast, with whom to spend your time, and what to do. Even when we're on a regular schedule, we don't behave like robots. We often have options to deviate from our regular course of action, and we must decide whether or not to take them.

decision making evaluating and choosing from among options.

Information for Decision Making

To make decisions, we need to gather or recall information relevant to each alternative. Suppose you're trying to decide which of two movies to go see. You would probably like a little information about each film to help you make your choice. You can gather information from sources outside yourself, such as movie reviews and the comments of your friends. You can also recall relevant information that you already have. You may, for example, recognize the names of some of the actors or one of the directors.

When we draw from our memories to get information, we often use heuristic shortcuts. The use of heuristics is sometimes successful, but often leads to reaching the incorrect decision, as shown in the work of Nobel prize-winning psychologist Danny Kahneman, who developed many of his studies while working at the University of British Columbia (Stanovich, 2011; Tversky & Kahneman, 1974, 1993; Gilovich, Griffin, & Kahneman, 2002; Kahneman, 2016). These researchers describe two heuristics: the representativeness heuristic and the availability heuristic.

The **representativeness heuristic** makes the assumption that individual objects or people are members of a category if they share similar characteristics. When we use this heuristic, we draw conclusions about an object, event, or person based on a small set of specific data, often ignoring other relevant information. Suppose, for example, that one of the movies you are thinking of seeing has several characteristics that seem to identify it as a romantic comedy. You may not bother to read reviews or get other information about the movie because, based only on its presumed identity as a romantic comedy, you have a set of expectations about what the movie will be like.

representativeness heuristic the assumption that individuals share characteristics of the category of which they are a member.

Hans Deryk/AFP/Getty Images

Unforgettable **Because horrific scenes of airplane crashes stay in our memories, we tend to think that such crashes are more common than they actually are via the availability heuristic.**

Amos Tversky and Danny Kahneman (1974) nicely demonstrated people's use of the representativeness heuristic by asking research participants to read a description of an individual that included personal attributes such as, "shows no interest in political and social issues," and "spends most of his free time on . . . mathematical puzzles." After they read this paragraph, participants were also told that the individual was randomly selected from a pool that contained 70 percent lawyers and 30 percent engineers. Ignoring the strong statistical probability that the individual was more likely to be a lawyer than an engineer, most of the participants used the personal characteristics of the individual to identify him as an engineer based on a few personal characteristics.

Another approximation used to make decisions is known as the **availability heuristic**. Answer this question: are there more words in the English language that start with the letter K or that have the letter K in the third position? We will come back to this shortly. The availability heuristic refers to the likelihood that we will judge an event as more common if it is easier to think about it (Kolb, 2014). You may easily remember the one really great film made by an actor in one of the movies you are thinking about seeing, but not be able to recall much about the actor's so-so work in several other films. The availability heuristic also explains why we tend to think that infrequent but highly salient and memorable events, such as plane crashes or tsunamis, are more common than they actually are (see photo). Because such events are easy to call to mind, we assume they commonly occur when, in fact, they are very rare (Chadee, Smith, & Ferguson, 2019). So what about the K question? There are actually more words in English with the letter K in the third position. However, words starting with the letter K are much more available when we try to think of them, so people usually say there are more words that start with K than have K in the third position (Tversky & Kahneman, 1974).

availability heuristic judging easily-recalled events as more common.

Another aspect of the availability heuristic that affects decision making is the fact that we tend to rely on more recently stored memories to make judgments about events. For example, patients who underwent painful medical colonoscopy procedures are more likely to remember the event as excruciatingly painful if it is over quickly and ends at a time of maximal pain, than if the procedure is extended for a longer period of time with some time at the end of diminished pain (Redelmeier, Katz, & Kahneman, 2003; Keating et al., 2017). Because it's easier to call more recent information to mind, we assume that it is more indicative of the overall experience.

Rational Decision Making

After we have gathered or brought to mind information about the alternatives, how do we evaluate each one and go about picking one of them? For thousands of years, since the time of the ancient Greek philosopher Plato, philosophers have argued that it is better to rely on logical reasoning than on emotions or instinct when making decisions. And, until relatively recently, many of the theorists and researchers who studied decision making assumed that

people's decisions—particularly financial decisions about what products to buy, whether to save or spend, and how to invest—were based on purely logical reasoning (see photo).

Sergei Bachlakov/Shutterstock.com

"Buy one now, before they're all gone" Recognizing that emotions can interfere with careful decision making, retailers typically try to create a sense of urgency and excitement when selling their products.

Numerous models of such rational decision-making processes exist. Many assume that we choose a set of criteria and rank each alternative on its *utility*, or its ability to satisfy each criterion (Edwards, 2013). If you are looking for a new phone, for instance, you might evaluate its size, cost, and the number of apps that are available. Some models of rational decision making suggest that we may go even further and give more importance or "weight" to certain criteria. If, for example, it is very important to have certain apps available on a new phone, you may weigh that criterion more highly than the phone's size and cost. According to these models, after gathering and evaluating information on each phone, you could mathematically calculate which phone is the best for you. Table 9.1 shows a model of such a calculation. According to this model, you would choose Phone C.

For some decisions, rational models of decision making suggest that we might also take into account the *probability* that we can attain our choices. If, for example, you are choosing classes for next term, the course that ranks as your top choice may be so popular on campus that you rate your chance of getting into the class as low. In this case, you may decide to sign up for another course, instead of your top choice, as part of your rational decision-making process.

TABLE 9.1

Model of Rational Decision Making: Considering Both Rank and Weight (Importance)

Criterion	Weight of Criteria	Phone A		Phone B		Phone C	
			Rank ×		Rank ×		Rank ×

		Rank	weight	Rank	weight	Rank	weight
Size	3	8	24	5	15	5	15
Cost	6	8	48	6	36	4	24
Apps	10	0	0	5	50	8	80
Total of rank × weight		**Phone A: 72**		**Phone B: 101**		**Phone C: 119**	

Reason-based decision-making methods such as these can help us when we have fairly few choices and evaluate them using fairly few attributes (Payne & Bettman, 2004; Bruch & Feinberg, 2017). Sometimes we cannot use such a model until we narrow down the choices (Slovic, 1990; Tversky, 1972). You may, for example, have eliminated 15 other phones that were entirely beyond your budget before choosing only three to consider further. Sometimes the method of eliminating alternatives is the only one we need. If every phone but one is beyond your budget, you don't need to perform a complicated analysis before deciding which phone you can get.

Rational decision-making models tend to be based on assumptions that we have information available to us about all our alternatives and that we have time to ponder this information. As you may have experienced, a lot of decisions in real life don't fit these criteria (Gigerenzer & Goldstein, 1996) and instead you may need to resort to a fast and frugal approach (Hafenbrädl, Waeger, Marewski, & Grigerenzer, 2016). After you buy your phone, for example, you may want to stop in the food court at the mall for a snack. With only a few minutes to decide, you may focus on only a few of the available options—maybe the first couple of restaurants you walk by—or a few attributes of the choices—such as whether they offer a vegetarian dish. You may still think rationally about your choice, but you are using a model known as **bounded rationality** that limits the cognitive effort you need to invest (Simon, 1957). The theory of bounded rationality suggests that our ability to make decisions in a rational, logical manner is limited by incomplete information, time limits of decision making, and our own emotional feelings about one or more of the available options. All of these factors limit or "bound" our ability to behave purely rationally. Research suggests that we *successfully* use bounded rationality to make many of our decisions by doing the best we can with the cognitive resources and information that we have available at a given moment (Mousavi, Gigerenzer, & Kheirandisch, 2016). (See Indigenous Experiences 9.2.)

> **bounded rationality** the fact that in many situations, our ability to make clear rational decisions is limited or "bounded" by things like a lack of information, time constraints, or emotions attached to aspects of the problem we are trying to solve.

This work on the biases and limitations that seem to get in the way of rational decision making raises an important question of whether they affect how we decide on and pursue our personal goals. Industrial/organizational psychologists study human and organizational performance in workplace and career-related settings and among students in academic settings (Vancouver, Weinhardt, & Vigo, 2014) and their work can be very informative when it comes to considering your own decisions. Imagine you have an exam tomorrow, but your friend is also having a party tonight that you know will be a lot of fun.

Do you study or party? More to the point, how rationally do you arrive at your decision? Check out the Taking Psychology to Work link in the margin to see what industrial/organizational psychologists can tell you about yourself and your decisions. It should make you think.

Emotions and Decision Making

Suppose you are perusing the food court for your snack and you get a craving for French fries. You might just buy some and eat them, without putting much—if any—rational thought into your decision. For a long time, decisions such as this troubled rational decision-making theorists, because such choices are not based on logical reasons. Because of the work of psychologists such as Danny Kahneman, however, we now know that decision making often involves irrational processes that can be driven by our emotions. In fact, people *often* rely heavily on their emotions, or "gut instinct," rather than pure reason to make decisions. Decisions made in business and organizations can be quite costly. For a look at how industrial/organizational psychologists study decision-making processes, check out the Psychology@Work video on Judgment and Decision Making.

Video **PSYCHOLOGY@WORK**

Judgment and Decision Making **This video looks at industrial/organizational psychology research into the challenges of goal setting and the avoidance of biases in decision making.**

The involvement of emotions in decision making makes predicting human behaviour very difficult. There are individual differences in emotional reactions, and many of these are driven by developmental experience and temperament. Even our day-to-day moods can affect our decision making. Research suggests, for example, that when we are in a positive mood, we tend to make more efficient decisions with less rational consideration of the alternatives. We also tend to be content with those choices (Lerner, Li, Valdesolo, & Kassam, 2015).

Researchers have discovered a few situations in which our emotions are likely to influence decisions somewhat predictably. One of these is when we try to estimate risks in anticipating the consequences of our decisions. For example, if you buy the wrong new phone, you risk being unhappy with it or needing to take it in for lots of repairs. Research suggests that we base our decisions, at least in part, on our anticipation of how we will feel if we make a bad choice (Kahneman & Tversky, 1979; Mellers, Fincher, Drummond, & Bigony, 2013), and that, in general, we try hard to avoid making decisions we will regret later (Van Dijk & Zeelenberg, 2005). For many of us, "bad" outweighs "good" in our anticipation, so we might make less than optimal choices just to avoid the risk of feeling bad later. Given the option to receive 10 cents of a shared (with one other person) dollar, for example, most people will opt out altogether, taking nothing instead of the 10 cents, because they would feel they had been treated unfairly by having to share the dollar. This is irrational behaviour, since 10 cents is clearly better than nothing at all.

9.2 Indigenous Experiences

Bridging Cultural Divides Through a Canadian Arctic Research Partnership

Cultural strategic thinking involves the perception of problems and situations and addressing issues based on one's metacognitive cultural understanding (Morris, Savani, & Fincher, 2019). It is therefore common for cultural divides to exist among different groups of thinkers from different cultures. A cultural divide exists when cultural differences hinder interactions and understanding between people of different cultures (Slater & Inagawa, 2019).

Cultural divides exist in the Canadian Arctic. Since pressing environmental issues have greatly increased the number of scientific research projects in northern communities, research licensing requirements in the three Canadian territories (Yukon, Northwest Territories, Nunavut) and from Canadian federal research granting agencies have explicitly called for the involvement of Indigenous communities in research (Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, & Social Sciences and Humanities Research Council of Canada, 2018; Tondu et al., 2014). Identifying a need for a "cohort of community-based trained research assistants available for deeper partnerships" (p. 1), Priscilla Ferrazzi from the University of Alberta and colleagues (2018) developed two cross-cultural workshops designed to train research assistants over a three-day period. The goal of the workshops was to encourage reciprocity between Indigenous and non-Indigenous researchers and to build relationships among community partners and researchers in the Nunavut communities of Arviat and Iqaluit.

With an established colonial history of harmful and unethical research practices in the Canadian North, it was important for the training workshops to establish trust and to create a balanced community–researcher partnership (Ferrazzi et al., 2018). The cross-cultural workshop framework therefore integrated educational objectives using Bloom's Taxonomy with research philosophies from Inuit knowledge (Inuit *Qaujimajatuqangit* – or IQ). Workshops involved presentations from Arctic researchers, Inuit Elders, graduate students, and others. Lived experience and personal knowledge from all participants was shared and valued.

Participants reported benefiting from exposure to culturally different worldviews on approaches to ethics, reporting: "I learned about the IQ principles. We should consider the relationship between these principles and Western principles when conducting research" and "The most important new thing I learned from this workshop was the critical role that ethics play in all stages of the research process, from the actual conduct of research itself to the cultural responsiveness (e.g., Indigenous vs. Western ethics in this context)" (p. 5). For example, participants discovered that Indigenous ethical frameworks are more relational than Western ethical frameworks. Instead of focusing on rules or policies designed to tell people what they ought to do in advance, the Indigenous perspective instead views each ethical situation as unique, dependent on the individual and the context. However, Indigenous and non-Indigenous workshop participants reported that both worldviews were useful in addressing research and community priorities and for "bridging cultural and ethical gaps in understanding between researchers and communities" (p. 6).

Source: Arctic Photo / All Canada Photos

Research partnership *Qaujimajatuqangit* translates as "Inuit traditional knowledge" and is a holistic worldview that recognizes interconnections among all places and living things.

Critical Thinking Questions

What are cultural divides and how might they interfere with clear communication between different cultural groups?

Why might an awareness and serious consideration of cultural divides between researchers and Canadian Indigenous communities be important parts of conducting research with those communities?

What sorts of things might be part of the diverse worldviews within Indigenous communities that researchers need to be aware of and consider?

Understanding how emotions can shift the likelihood of a purchase is of particular interest to advertisers. If the context that produces positive emotion can be identified in all situations, it can be used effectively to persuade consumers to buy. In many cases, language can play a role in producing this context by framing choices in positive or negative ways. We are more likely to buy a food that is labelled "75 percent fat-free" than one that is described as "25 percent fat," for example (Sanford, Fay, Stewart, & Moxey, 2002; Hohle & Teigen, 2018). The first statement frames the product in terms of "fat-free," and as such is preferred to the second statement, even though the product is exactly the same in both cases.

Framing is especially effective in arousing emotions when we are estimating risks. Most university or college students would feel safer using condoms that prevent the transmission of HIV 95 percent of the time than the same condoms when they are described as failing to prevent HIV transmission 5 percent of the time (Linville, Fischer, & Fischhoff, 1993). Tversky and Kahneman (1981) provided another classic example of framing. They asked students to imagine that they were helping Health Canada select a

treatment scenario for an outbreak of an expected deadly disease. Imagine that you are one of the students in their experiment. You are told that it is estimated that 600 people will contract the disease and die without treatment. You are told that Treatment Option A will save 200 of those affected, while Treatment Option B has a 1/3 probability of saving all 600 people and a 2/3 probability that none will be saved. Which option would you pick? Now what if, instead, you were offered the following two options. Treatment Option C would result in the deaths of 400 people, while with Treatment Option D there is a 1/3 probability no one will die and a 2/3 probability that all 600 will die. Which of these options would you pick? In Kahneman and Tversky's study, most people preferred Options A and D, even though options A and C are identical, as are Options B and D. The researchers explained their finding as due to differences in framing the options in terms of life or death.

The interference of emotions in making decisions is not all negative. Although it's true that being upset or anxious or feeling cheated or irrationally hopeful may impair our judgment and increase the chance that we will make an impulsive and unnecessary purchase, it is sometimes the case that emotions help us make better decisions. Research has shown that individuals often make better decisions in games with a chance element when they claim to be operating on a "hunch." Intuition is not well understood, but it is an irrational characteristic that sometimes improves decision-making capabilities. The bottom line seems to be that particularly in emotional decision situations you may be best off "going with your gut" or your intuitive feelings as to what to do (Mikels, Magglio, Reed, & Kaplowitz, 2011; Lufityanto, Donkin, & Pearson, 2016).

Photo by Tyrell James on Unsplash

Mind-reading **An important part of all social interactions and a very important part of playing competitive games is figuring out what others are thinking and planning.**

Metacognition

One of the most complicated forms of thought is **metacognition**, thinking about thinking. When we consider our own memories, for example, we engage in a form of metacognition. We may mull over specific facts we remember, thinking about their sources and when we learned them. We may also think about how information we have learned in the past is influencing our current interpretations of events. Metacognition involving thinking about the source of memories involves activation of the frontal cortex of the brain as well as the hippocampus, a region important for storage of information. Damage to the hippocampus can result in source amnesia, a condition that prevents accurate thinking about one's own memories (Markowitsch & Staniloiu, 2012).

metacognition thinking about one's own thoughts.

Self-reflection is another form of metacognition. It involves thinking about our own identities, how we influence other people, and our relative self-worth. Self-reflection is an

important human behaviour because it enables us to evaluate and modify our responses based on our past experience. We may reflect on our behaviour at a recent party, for example, and decide that we would feel better about ourselves if we were more, or perhaps less, outgoing. Then we might take steps either to overcome shyness or tone down our party persona. Self-reflection can sometimes have negative consequences if it leads to repetitive thoughts of worthlessness and anxiety. For people with specific biological tendencies, excessive self-reflection can lead to psychological disorders, such as depression and anxiety disorders (Philippi & Koenigs, 2014). Find out about the significant potential benefits of focusing your metacognitive thought processes in Positive Psychology 9.2.

Another type of metacognition occurs when we infer what someone else is thinking by watching or hearing about that person's actions (see photo). This phenomenon, called **theory of mind**, is an important aspect of human thought. As we discussed in Chapter 4, theory of mind is an adaptive trait because it facilitates communication and peaceful living with other people. If we did not have theory of mind and instead needed explicit verbal information about the feelings and intentions of another person, social communication would be stilted.

theory of mind an awareness of one's own mental states and the mental states of others.

9.2 Psychology Around Us | Positive Psychology

Thinking About Our Own Thinking: The Impact of Mindfulness Training

One of the hottest topics in psychology and neuroscience today is metacognition. How you think about the environment around you and allow it to influence your own thinking impacts your emotional state, your ability to remember significant events and facts, and even more importantly, what psychologists call your executive function. Your ability to consciously think about your own thoughts, to consider and control how your thoughts are affecting your behaviour, and to consciously decide to change your thought patterns are all aspects of executive function and metacognition. For example, if you are angry at a roommate for eating the food you had saved in the fridge, you could just cut loose and yell at them, potentially damaging a great friendship, or you could take a deep breath, think carefully about what you want to say, and create an environment where the two of you can talk through your frustrations without yelling or physical demonstrations of anger. This second option happens when you think about your own thinking or your metacognitions.

Mindfulness training, one form of meditative practice (see Chapter 14 for more on meditation), is one technique that we can use to improve our metacognitions and control what our brain focuses on in our everyday environments. Developing mindfulness skills allows us to ignore the extraneous stimuli (cellphones, Netflix, Snapchat, Instagram—the list goes on!) that distract us from a task we may be trying to complete. They can also help keep us focused on the important features of our current surroundings; for example, other people, not our phones. Learning to be fully aware and engaged in our present experience, or with the people around us, is a great

skill to have as you move through university or college. As part of mindfulness training, individuals are also given tools to become aware of the thoughts and feelings they may be having in the present moment and develop strategies to prevent these thoughts and feelings from taking over and overwhelming our sense of well-being.

Studies have shown that when students become more self-aware of their psychological states, and take time to think carefully about them, they are more likely to feel a decrease in anxiety and stress and an increase in self esteem, and are better able to maintain conscious control of their thought processes and focus on a task (Meiklejohn et al., 2012). The increased ability to modulate one's thoughts and attentional processes with mindfulness meditation may be due to the alteration of neural signalling in the frontal and parietal lobes (Bailey et al., 2019). More research is needed to fully understand how mindfulness training alters the functioning of the brain (Chiesa, Calati, & Serretti, 2011; Sanger & Dorjee, 2016) and how it influences our thoughts, but for now the evidence for mindfulness training being one way to impact and alter our metacognitions looks promising!

Once we acquire this ability during development, it becomes automatic. You probably exercise your theory of mind many times a day, while assessing your roommate's mood on the basis of his actions, gauging a professor's expectations based on her demeanour, or trying to figure out what type of a person your date is from the cues you receive on the first date.

How Metacognition Develops

Children gradually develop a theory of other peoples' minds, starting during the toddler years. Young children, ages 2 to 3 years, demonstrate that they lack the ability to infer the thinking of the person who is searching for them when trying to play hide-and-seek. Children this age will often "hide" by covering their eyes while remaining in a location that is not out of view (see photo). Piaget (2003) referred to this sort of preschool thinking as egocentric (see Chapter 4). Rather than take the point of view of the searcher, they rely on their own experience, believing that "If I can't see because my eyes are covered, no one else can see me." This lack of theory of mind disappears by about age 4 (Slaughter & De Rosnay, 2016). The disappearance of this odd form of hiding may reflect a drop in egocentrism reflecting a lack of a theory of mind or it may be due to a realization that both people do not need to see one another at the same time, reciprocally, to be "seen" (Moll & Khalulyan, 2016).

Thinkstock/Getty Images

Hiding in plain sight Young children lack the ability to infer what another person is thinking and will often "hide" by covering their eyes . . . "If I can't see you, you can't see me!"

Young children's developing theory of mind may contribute to jealousy and an inability to share when it makes it possible for a child to think of another child as a rival intending to take away her toys. Another behaviour that is tied to thinking about what's going on in another person's head is lying. In general, people lie for two main reasons: to prevent themselves from being punished or to make someone else feel good (Feldman, 2009, 2013). Children learn very young to lie in order to avoid punishment. This behaviour seems to emerge around age 3 for most children, and by age 5 it is a fairly universal phenomenon (Lavoie et al., 2017a; Talwar, Lavoie, Gomez-Garibello, & Crossman, 2017). If "backed into a corner" so that a child believes it's likely he will be punished, almost all 5-year-olds will lie. Theory of mind allows people to lie in hopes of preventing punishment, even if they have not explicitly been warned about the punishment (Lavoie, Vachison, Crossman, & Talwar, 2017b). Because the child is able to imagine that an adult believes the child's behaviour is wrong, she can then infer that the adult intends to punish her for the wrong behaviour.

Lying to make another person feel better, such as giving false compliments or reassurances, is another behaviour that arises during the preschool years. Unlike lying to avoid punishment, however, this type of lying seems to increase in frequency as we get older (Williams, Moore, Crossman, & Talwar, 2016). Have you ever complimented a friend on a new haircut or new outfit that you actually felt was less than flattering? The chances are you did not feel particularly guilty afterward, because your thoughts about how your friend feels are stronger than your desire to always tell the truth.

Although theory of mind seems to be present in very young children, other forms of metacognition are not evident until much later in development. For example, thinking about their own memories and evaluating current information in the context of the past is not a common thought process of young children. Young children often suffer from source amnesia (not remembering where they heard about certain information), which not only makes them prone to develop false memories, but also interferes with their ability to think about their memories in a meaningful way (Roberts, Evans, & Duncanson, 2016).

Problems with Thought Processes

One of the ways we can better understand how we function psychologically is to look closely at what is going on when we are not functioning well. Understanding what sorts of conditions negatively affect our thought processes can help us to better understand how those thought processes work. Many disorders include problems with thinking. In many cases, however, these conditions are primarily associated with deficits in other psychological processes; impairments in the person's thinking are not the main difficulty. Individuals with Alzheimer disease are often in a confused state, for example, but the reason they are not thinking clearly is because their memories are disrupted. In other cases, problems with thinking are tied to aberrant emotional states. Depression is often accompanied by repetitive thoughts about worthlessness and hopelessness, and cognitive therapy that targets these thoughts can often be a successful form of treatment (Hofmann et al., 2012; Cuijpers, Berking et al., 2013). Although the thought components of dementia and mood disorders are real and significant symptoms, we discuss them in other chapters because these conditions are primarily associated with other psychological processes. Another two disorders, obsessive-compulsive disorder and schizophrenia, are characterized primarily by difficulties in controlling one's thoughts, so we will describe them briefly here as it is worth looking at what they might suggest to us about human thought processes. They will, however, be discussed in greater detail in Chapter 15.

Obsessive-compulsive disorder (OCD) is defined as having uncontrollable, anxiety-provoking thoughts called *obsessions*. Many people with this disorder feel *compulsions*, or irresistible urges, to perform mental or physical ritual actions to help reduce their anxiety around their obsession (APA, 2013). People with OCD know that their obsessions are out of contact with reality, but they often find the thoughts impossible to inhibit and ignore. For example, a person might have obsessive thoughts about germs and anxiety that could lead to compulsive hand washing, or a person may have obsessive thoughts about his children being harmed that could lead to compulsively checking that the stove is not on. The impulse to engage in compulsive behaviour, such as washing one's hands over and over or repeatedly checking whether a stove has been turned off, is so strong that anxiety builds with each passing moment that the behaviour is inhibited (Magee, Harden, & Teachman, 2012). OCD can range from relatively mild to extremes that render people unable to participate in normal life activities. Estimates of the prevalence of OCD are uncertain because many people with mild OCD do not receive a formal diagnosis. Conservative estimates suggest that OCD affects about 2 percent of the population (Langlois et al., 2015).

> **obsessive-compulsive disorder (OCD)** a mental disorder associated with abnormal anxiety-provoking thoughts that can lead to ritualistic behaviours.

The increase in anxiety-provoking thoughts associated with OCD is a good example of the complexity of human thinking. The relationship between our thoughts and our reality is actually something that can be stretched or even broken with disorders like OCD. As we come to understand the factors underlying OCD, we may also come to understand some of the key control factors involved in non-disordered human thinking. We will examine this topic in greater detail in Chapter 15.

Schizophrenia is another disorder that involves some of the most basic and most

important aspects of the human thinking process. Schizophrenia is a relatively common psychotic disorder that is characterized by extreme disorganization of thinking. About 1.1 percent of people in Canada have been diagnosed with some form of schizophrenia (Langlois et al., 2015). Although schizophrenia can exist in multiple forms, a common theme in the disease is a break from reality in thoughts and actions. Some people with schizophrenia experience distortions of reality, distortions in the form of *hallucinations* (usually auditory), and *delusions*, beliefs that are not based in reality (APA, 2013). They also exhibit a devastating inability to plan and control their own thoughts (Frith, 2014). Furthermore, many people with this disorder suffer impaired working memory and find it impossible to keep track of information necessary to execute a simple series of actions (Bittner et al., 2015; Huang et al., 2019).

> **schizophrenia** a mental disorder characterized by disorganized thoughts, lack of contact with reality, and sometimes auditory hallucinations.

Schizophrenia often also includes a language component. Sometimes a person's speech and writing become entirely disorganized and out of touch with reality (Sarioglu et al., 2018). However, in spite of the nonsensical content, many people diagnosed with schizophrenia are able to retain intact semantics and syntax in sentence construction (Kuperberg, 2010a, 2010b). Essentially, schizophrenia attacks the parts of our thinking processes that make us rational. Understanding the effects of schizophrenia on the brain will also provide us with an understanding of higher level human thinking. Potential causes and treatments of schizophrenia will be discussed in Chapters 15 and 16.

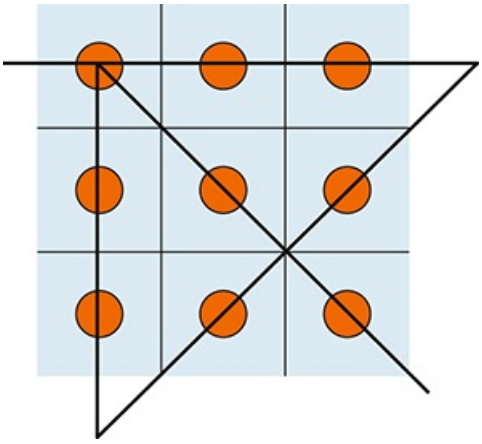


FIGURE 9.11 Solution to the nine-dot problem Most people have difficulty with this problem because they see the arrangement of dots as a square and try to keep within the boundaries of the dots. This mental set limits their ability to solve the problem.

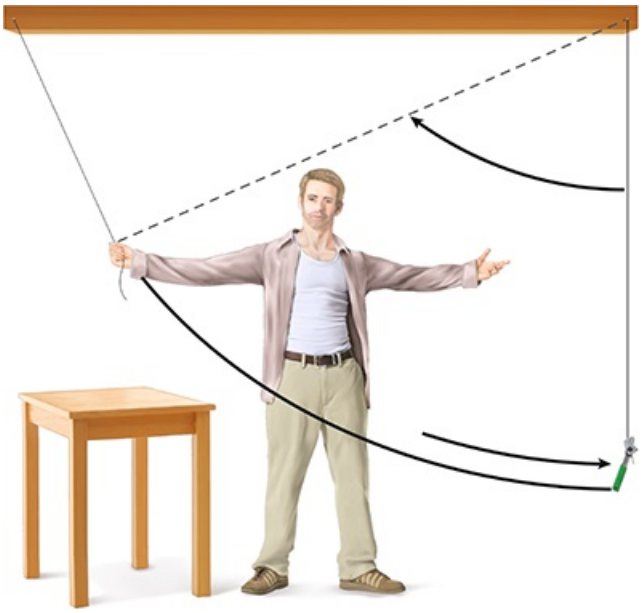


FIGURE 9.12 Solution to the string problem **Tie the pliers to one string and use it as a weight to swing the string closer to you. Functional fixedness can limit your ability to recognize this use for the pliers.**

Findings on the water jar problem in Figure 9.8 **Did your friend find the simpler solution to the 5th row problem that you missed (Jar A plus Jar C, instead of Jar B minus Jar A minus Jar C twice)? This classic experiment by Abraham Luchins (1942) demonstrates mental set. Most people who start at the top of the list figure out a solution and then apply it to all the problems. This creates a mental set that leads them to miss the simpler two-jar solution to the last row. Those starting at the bottom of the list are much more likely to see and use the simpler solution. How did you do?**

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

8. Compare and contrast controlled and automatic cognitive processing.

9. What are the two main types of strategies for solving problems? How do these two strategies differ? Give at least one example of each type.

10. What are the representativeness and availability heuristics and how do they affect decision making?

11. How can emotions affect our decision making?

12. What is metacognition? What is a theory of mind?

13. How is thinking disturbed in OCD? How are thinking and language disturbed in schizophrenia?

What Do You Think? • Which of the barriers to problem solving described in this chapter most often seem to affect you? Which problem-solving strategies seem to work best for you?

Summary

Language

LEARNING OBJECTIVE 1 Define language, describe how we learn languages, describe parts of the brain that are involved in language, and discuss differences and problems that can affect people's language skills.

Language is a set of symbols used to communicate. Language comprehension involves understanding verbal messages, and language production involves creating them.

The study of language can be broken into phonology (sounds), semantics (meaning), syntax (grammar), and pragmatics (practical usage).

Most people follow a typical sequence of language acquisition that includes the ability to distinguish, but not produce, all possible phonemes at about 2 to 4 months of age, babbling at about 6 months, and speaking first words at around 1 year of age.

The standard way we learn language suggests that we have an inborn capacity for language learning, although environment contributes as well. There appears be a sensitive or critical period before about 13 years old when it is easiest to acquire language.

In most people, the language centres in the brain are in the left hemisphere. The main brain region important for speech production is Broca's area. The main region for language comprehension is called Wernicke's area. Several other areas of the brain are also active in language, including the frontal eye fields when we read.

There are small average gender differences in early language learning, with girls initially learning faster. These differences disappear with time.

The Relationship between Language and Thought

LEARNING OBJECTIVE 2 Describe how thought and language are related and summarize the linguistic relativity hypothesis.

Some thoughts, including mental imagery and spatial navigation, require no words.

The linguistic relativity hypothesis suggests that the amount of vocabulary we have available in our language for objects or concepts influences the way we think about those objects or concepts.

Thought

LEARNING OBJECTIVE 3 Describe and summarize research on thinking processes, including problem solving, decision making, and metacognition.

We are capable of several different kinds of thought, and different types of thinking involve different brain regions, often including those related to the specific thoughts. We develop various thinking abilities gradually with age.

Controlled processing relies on the executive function of the brain. We become increasingly able to exert cognitive control as we age.

Problem solving is finding a way to reach a goal. Algorithms, problem-solving strategies that guarantee a solution if followed methodically, work best for well-defined problems. Shortcut strategies called heuristics may help with ill-defined problems.

Common problem-solving heuristics include working backwards, finding analogies to other problems, and forming subgoals. Heuristics can lead to difficulties in problem solving, including mental sets, functional fixedness, and confirmation bias.

Decision making involves evaluating and choosing from among the options available to us. We often use heuristics to recall information to make decisions, but some, including the representativeness and availability heuristics, can bias our evaluations.

Rational models of problem solving suggest that we make elimination options and/or make weighted evaluations of the utility and probability of options. We often lack time, information, or cognitive resources for rational decision making, however, so we use a strategy of limited or bounded rationality.

Emotions often play a role in decision making, sometimes interfering with our ability to make rational decisions, but other times helping us to make efficient choices.

Metacognition is thinking about our own thoughts. It includes reviewing and evaluating our own memories, self-reflection, and theory of mind—inferring the intentions of other people.

Obsessive-compulsive disorder (OCD) and schizophrenia are two mental disorders that include major thought disruptions.

Key Terms

agrammatism

algorithm

availability heuristic

babbling

bounded rationality

Broca's aphasia

Broca's area

child-directed speech

cognition

cognitive control

confirmation bias
critical period
decision making
dysexecutive syndrome
executive function
functional fixedness
heuristic
language
language comprehension
language production
lexical meaning
linguistic relativity hypothesis
mental imagery
mental set
metacognition
morpheme
non-verbal communication
obsessive-compulsive disorder (OCD)
overregularization
phoneme
phonology
pragmatics
problem solving
representativeness heuristic
schizophrenia
semantics
sensitive period
speech
syntax
telegraphic speech
theory of mind
Wernicke's aphasia
Wernicke's area

Self-Study Questions

Multiple Choice

1. Which of the following sequences correctly orders the components of language from the smallest or most specific to the broadest?

a. phoneme → morpheme → syntax

b. phoneme → syntax → morpheme

c. syntax → morpheme → phoneme

d. syntax → phoneme → morpheme

2. By what age do most normally-developing babies begin to babble?

a. 1 month

b. 2 months

c. 4 months

d. 6 months

3. A "critical period" in language development is a period during which

a. children are proficient in their first language.

b. children must receive stimulation to learn language.

c. the brain forms neural connections for language learning.

d. the brain is receptive to language learning.

4. How does the critical period for deaf children acquiring sign language compare to the critical period for hearing children acquiring spoken language?

a. The critical period for deaf children acquiring sign language is essentially the same as the critical period for hearing children acquiring spoken language.

b. The critical period for deaf children acquiring sign language is longer than the critical period for hearing children acquiring spoken language.

c. The critical period for deaf children acquiring sign language is shorter than the critical period for hearing children acquiring spoken language.

d. There is no critical period for deaf children acquiring sign language, whereas there is a critical period for hearing children acquiring spoken language.

5. Which of the following alternatives best describes gender differences in language development from birth to about age 2?

a. Both speech and language comprehension develop earlier in girls than in boys.

b. Speech develops earlier in boys than in girls, but language comprehension develops earlier in girls than in boys.

c. Speech develops earlier in girls than in boys, but language comprehension develops

at the same rate in girls and in boys.

d. There are no gender differences in language development from birth to age 2.

6. If you imagine rearranging the furniture in your home and vividly picture the room, which lobe of your brain is likely to be active?

a. frontal

b. occipital

c. parietal

d. temporal

7. Which of the following statements best expresses the linguistic relativity hypothesis?

a. Language influences thought.

b. Language is equivalent to thought.

c. Language is unrelated to thought.

d. Thought determines language.

8. A political science professor attempts to facilitate her students' completion of a term paper assignment by requiring that they first submit a topic statement, then a list of references, then a draft of the introduction, and then, finally, the completed paper. The professor is encouraging her students to use the problem-solving strategy of

a. forming subgoals.

b. trial and error.

c. using an analogy.

d. working backwards.

9. Although James worked on his chemistry homework for several hours, he still did not understand it. While taking a break to watch television, he gained insight into the processes he had studied. What term describes his "break"?

a. critical period

b. encoding period

c. incubation period

d. retrieval period

10. We tend to take evidence that is consistent with our beliefs more seriously than evidence inconsistent with our beliefs. This is known as the

a. availability heuristic.

b. confirmation bias.

c. representativeness heuristic.

d. selection bias.

Fill-in-the-Blank

1. Humans make new sentences each time they speak. This refers to the concept that language is creative or _____.

2. Three-year-old Maya said, "I thinked about it." This is an example of the linguistic error called _____.

3. The term _____ refers to a deficit in either language production or language comprehension.

4. The brain region critical for speech production is _____ area, located in the motor association cortex.

5. Mental imagery refers to thoughts that involve conjuring up _____ representations of stored sensory input.

6. Evidence supporting the linguistic relativity hypothesis comes from _____ psychology.

7. A rule that guarantees the solution to a problem when it is correctly applied is a(n) _____.

8. When we make decisions based on how easily information comes to mind, we are using the _____ heuristic.

9. Young children are often poor eyewitnesses because they have trouble remembering where they heard about certain information, a difficulty known as _____ amnesia.

10. The ability to think about another person's intentions is linked to the _____.

CHAPTER 10
Intelligence

Hongqi Zhang/Alamy Stock Photo

CHAPTER OUTLINE

What Do We Mean by Intelligence?

LEARNING OBJECTIVE 1 Describe various ways in which intelligence has been defined and summarize the current thinking on whether intelligence is general or specific.

How Do We Measure Intelligence?

LEARNING OBJECTIVE 2 Identify important considerations in the construction of intelligence tests, discuss the history of intelligence testing, and describe some criticisms of intelligence tests.

Additional Types of Intelligence

LEARNING OBJECTIVE 3 Discuss several proposed types of intelligence that go beyond intellectual functioning.

How Is Intelligence Influenced by Biological and Environmental Factors?

LEARNING OBJECTIVE 4 Review the contributions of biological and environmental factors to intelligence, and explain how emphasizing different factors can affect social policy.

The Brain and Intelligence

LEARNING OBJECTIVE 5 Describe how brain size, number of neurons, processing speed, brain activity, and cortical maturation relate to intelligence.

Extremes in Intelligence

LEARNING OBJECTIVE 6 Discuss intellectual disability and giftedness.

How can you tell if someone is intelligent? What sorts of behaviours should you look for? How well they did in school? How much money they earn at work? Perhaps if we had an example to work from . . . someone unmistakably intelligent. What about the character of Sheldon Cooper on TV's *The Big Bang Theory?* Is he intelligent? Well, he certainly thinks so. He sped through school, going to university at the age of 11 and graduating at 14. Sheldon does research in cutting-edge physics and in the last episode of the series accepts the Nobel Prize he always said he would win. Indeed, Sheldon is an intelligent character who collects comics and excels in theoretical physics, and yet there are some, well, . . . issues. He is self-centred, arrogant, and socially inept, and at times in social situations he looks particularly incompetent. His friends find him extremely frustrating; after living with him for weeks at a remote North Pole research station, his friends admit that they wanted to kill him, even temporarily considering throwing his Kindle outside and locking the door when he went out to get it! He is both brilliant and seriously challenged.

Sheldon's character is built around common, if somewhat stereotyped, conceptions of what intelligence is. Like many other aspects of human behaviour, however, intelligence is a concept that appears simple at first glance, only to become more complicated the closer we look at it. Start with the basic question: How do you define intelligence? Most people characterize the intelligence of people in their lives, and they generally have a great deal of confidence in their assessments. But answer this: When you describe a friend as a generally smart person, how are you assessing smartness? Are you thinking about how your friend performs in all situations, or are you simply impressed by how sophisticated her answers are in psychology class and ignoring the fact that she's just scraping by in chemistry? If you were watching Sheldon Cooper on *Big Bang*, would you be sympathetic to him despite his lack of "street smarts" or would you find him arrogant and abrasive? Would Sheldon, book smarts and all, be the one you would want leading you if your plane crashes on a remote island?

So what do we mean by intelligence? Does it mean the same thing in every instance? How do we understand it, and how do we measure it? To these basic questions we must add several others:

Can we distinguish between intelligence and talent?

Are intelligence and wisdom the same thing?

Are intelligence and creativity related?

And, finally, how do we value intelligence?

Our answers to such questions will influence how we define intelligence and whether we decide that anyone is particularly high in intelligence.

What Do We Mean by Intelligence?

LEARNING OBJECTIVE 1

Describe various ways in which intelligence has been defined and summarize the current thinking on whether intelligence is general or specific.

Although Western thinkers as far back in history as Socrates, Plato, and Aristotle have commented on intelligence, it was not until the nineteenth and early twentieth centuries that psychologists and others began to form our current notions about it. In 1921, a group of scholars attended a symposium on the subject of intelligence (Thorndike, 1921). In their report, they emphasized that whatever else might be involved, **intelligence** involves the ability to *learn and the ability to meet the demands of the environment effectively*. People who hope to master algebra, for example, must have the capacity to grasp mathematical principles and profit from mathematical instruction, and they must be able to apply what they learn to various problem sets and life situations. As we will see later, we need to be careful about how broadly we apply the "meeting the demands of the environment" criteria for intelligence. As mentioned, Sheldon, one of the main characters in *The Big Bang Theory* television show, is certainly intelligent, and certainly well adapted to the environment of the field of physics, but he is quite inept in social situations.

> **intelligence** the ability to learn, to meet the demands of the environment effectively, and to understand and control one's mental activities.

Years later, another survey of scholars pointed to these same abilities—learning and meeting the demands of the environment—as keys to intelligence, and added a third: *the ability to understand and control one's mental activities*. This additional mental capacity was termed **metacognition** (Fleming & Frith, 2014). Sometimes metacognition is understood as the ability to think about one's own thinking (see photo). The ancient philosopher Socrates gave us an early example of metacognitive thinking when he proclaimed, "Know thyself." A better example might be that studying is a way of meeting the demands of the academic environment, while knowing when you have studied enough and are ready for a test is a metacognitive skill.

> **metacognition** the ability to understand and control one's mental activities.

David English Photos/Alamy Stock Photo

"The Thinker" Metacognition involves thinking about thinking.

Defining intelligence in terms of our ability to learn, to adapt to the demands of our environment, and to reflect on and understand our own mental processes makes intuitive sense. However, this definition encompasses a wide variety of notions about what intelligence might be. To develop a more precise definition, let's begin by considering a very basic question: is intelligence just one thing, or is it a combination of many different skill sets? All current theories of intelligence consider this question in one way or another.

Is Intelligence General or Specific?

Suppose you were joining a challenging mountain-climbing expedition. Which of your team members do you think would be more likely to complete the climb successfully: a generally smart person, or a person who had mastered, one by one, a large number of important tasks associated with mountain climbing? In other words, is intelligence largely the result of a single, general factor, or does it come from a cluster of different, more focused abilities?

Spearman and the *g* Factor

Charles Spearman (1863–1945) was a psychologist/philosopher and British army officer who was also an influential figure in the study of intelligence. Spearman helped to develop a tool for analyzing intelligence, called **factor analysis**. Factor analysis is a statistical method for determining whether different items on a test correlate highly with one another, thus forming a cluster of items (Spearman, 1937, 1927, 1923, 1904). In the case of intelligence tests, for example, people who do well on vocabulary items also tend to do well on other verbal items, such as reading comprehension. Taken together, all of the test items relating to words and reading form a verbal-reasoning cluster that can be used to assess a person's overall verbal-reasoning skill. On Western intelligence tests, other clusters relate to logical, spatial, and mechanical reasoning abilities (Schneider & Newman, 2015).

factor analysis a statistical method for determining whether certain items on a test correlate highly, thus forming a unified set, or cluster, of items.

While Spearman agreed that some people, like Sheldon, have a particular strength in one area or another, he also noticed that those who scored high on one cluster tend to score high on other clusters as well. As he put it, "A bright child tends to score higher on all aspects of an intelligence test than a dull one." Thus, he hypothesized that a general factor, the ***g* factor**, of intelligence, underlies all distinct clusters of mental ability. At the same time, he believed that each cluster of intelligence is further affected by a *specific factor*, an ***s* factor**, which is uniquely tied to that particular area of functioning (see **Figure 10.1**) (Spearman, 1937, 1927, 1923, 1904).

***g* factor** a theoretical general factor of intelligence underlying all distinct clusters of mental ability; part of Spearman's two-factor theory of intelligence.

***s* factor** a theoretical specific factor uniquely tied to a distinct mental ability or area of functioning; part of Spearman's two-factor theory of intelligence.

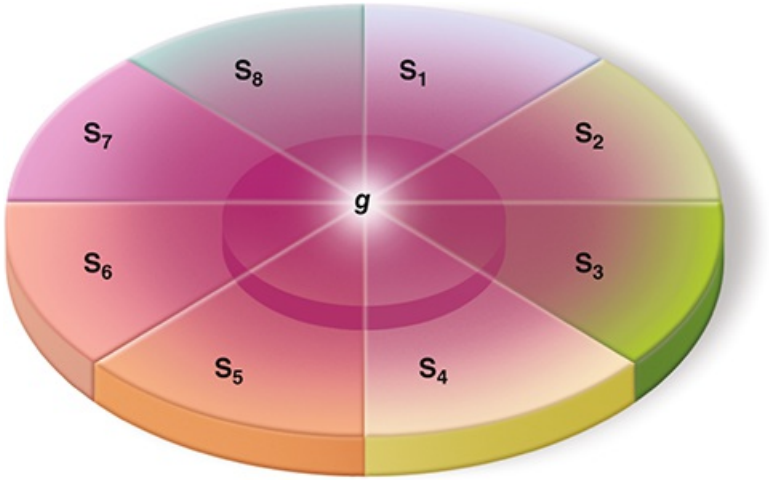


FIGURE 10.1 Spearman's two-factor theory of intelligence In Spearman's model, the *g* factor of intelligence represents a broad and deep capability that underlies all other specific mental abilities, or the *s* factors.

To illustrate this *two-factor view* of intelligence, think again about Sheldon Cooper on *The Big Bang Theory*. There is certainly variability in some areas of Sheldon's knowledge—he cannot drive a car nor understand how to make a friend. At the same time, there are many areas where Sheldon is very knowledgeable. He is a brilliant theoretic physicist, multilingual (Klingon, Swedish, Finnish, Hindi, Mandarin), is musical (piano, bongos, recorder, and theremin), and has extensive knowledge of most subjects, including vexillology (the study of flags)—all of which are consistent with the existence of a general intelligence.

Over the years, many theorists have embraced Spearman's notion of a *g* factor, and researchers have repeatedly found indications that such a factor may indeed be at work

(Ackerman, 2016; Castejon, Perez, & Gilar, 2010). These theorists typically agree that the *g* factor "is not merely book learning, a narrow academic skill, or test-taking smarts. Rather, it reflects a broader and deeper capability for comprehending our surroundings. Interestingly, it may not be just our species that has a *g* factor of intelligence. Other primates and several bird species may have a *g* factor as well (Bouchard, 2014; Burkart, Schubiger, & van Schaik, 2017).

TABLE 10.1

Thurstone's Seven Factors of Intelligence

Factor	Examples
Verbal comprehension	Vocabulary, reading, comprehension, verbal analogies, etc.
Word fluency	The ability to quickly generate and manipulate a large number of words with specific characteristics, as in anagrams or rhyming tests
Numerical skill	The ability to quickly and accurately carry out mathematical operations
Spatial ability	Skill in spatial visualization as well as the ability to mentally transform spatial figures
Associative memory	Rote memory
Perceptual speed	Quickness in perceiving visual details, anomalies, similarities, etc.
Reasoning	Skill in a variety of inductive, deductive, and arithmetic reasoning tasks

Thurstone and Primary Mental Abilities

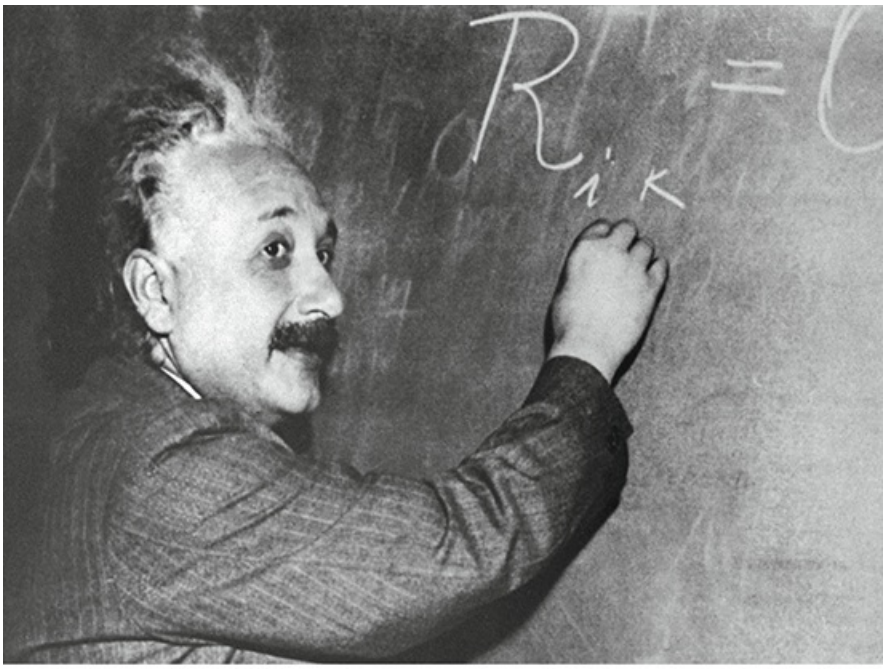
Although many theorists initially accepted and indeed continue to embrace Spearman's notion of a *g* factor of intelligence, the idea of such a general factor was controversial in Spearman's day and remains so to the present.

An early critic of Spearman's ideas was Louis L. Thurstone (1887–1955), a pioneer in psychological measurement and statistics. He argued that intelligence is made up of seven distinct mental abilities: verbal comprehension, word fluency, numerical skill, spatial ability, associative memory, perceptual speed, and reasoning (Thurstone, 1938; see **Table 10.1**). Thurstone termed these factors **primary mental abilities**.

> **primary mental abilities** seven distinct mental abilities identified by Thurstone as the basic components of intelligence.

Observing differences from person to person, Thurstone argued that each of the primary mental abilities on his list was distinct, not simply a reflection of general underlying intelligence. And, in fact, his initial work seemed to suggest that these abilities were not related. However, recognizing this theory as a direct challenge to the notion of the *g* factor, Spearman and others used factor analyses to reevaluate Thurstone's ideas. The researchers

detected at least a slight tendency of those who scored high in one mental ability to score high in another (Spearman, 1939). So, Thurstone's work did not entirely dispel the notion of the *g* factor.



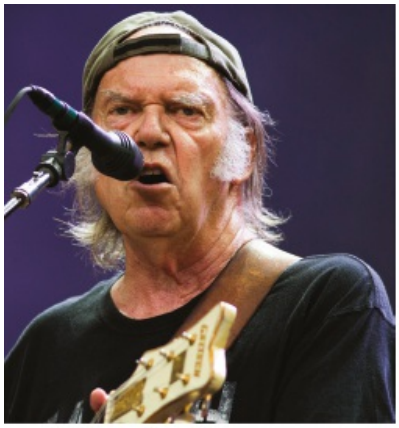
Bettmann/Getty Images

Who was the smartest person ever? It depends on your criteria. Although Albert Einstein's name has become synonymous with the term "brilliance," his cognitive functioning was below average in certain ways. Viewed as the ultimate absent-minded professor, he once had to call the dean's office at the Princeton Institute for Advanced Study to ask for directions to his home—located a block from campus.

Despite the limitations of Thurstone's theory, the idea of distinct areas of intelligence has continued to drive theorizing about intelligence, even among those who believe that a *g* factor is at least partly involved in intellectual functioning. Let's turn next to the work of three modern theorists who have carried on Thurstone's quest to identify separate components of intelligence.

Current Multifactor Theories of Intelligence

Most of the early theorists on intelligence agreed with Spearman that intelligence has a *g* factor at its core. Today's psychologists increasingly question the *g* factor, or at least place more emphasis on specific abilities, or *s* factors, that may affect intellectual performance (see photo). Three theorists in particular—Howard Gardner, Robert Sternberg, and Stephen Ceci—have broadened the definition of intelligence and deemphasized the *g* factor.



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Who is more intelligent? According to Howard Gardner's theory of multiple intelligences, these three extraordinary individuals each have a different kind of intelligence. For Neil Young, it's musical intelligence. For award-winning author Margaret Atwood, it's linguistic intelligence. And for physicist the late Stephen Hawking, it was mathematical intelligence.

Howard Gardner's Theory of Multiple Intelligences

Are you equally successful in every academic subject? If you are like most people, you probably do better in some areas than others. If you are a good academic student, are you also a good artist? Musician? Cook? Do you know someone who does not do well on academic tests, but nevertheless seems intelligent? Perhaps this person has strong leadership skills or entrepreneurial skills, social intuition, street smarts, athletic prowess, or a razor-sharp sense of humour (see photos).

Psychologist Howard Gardner, influenced in part by the work of Thurstone, has advanced the **theory of multiple intelligences**, which argues that there is not a single unified intelligence (Gardner, 2011; Moran & Gardner, 2018; Sternberg, 2015). Instead, Gardner believes that there are several independent intelligences. Drawing on research from the fields of neuroscience and developmental, evolutionary, and cognitive psychology, he claims that the different intelligences come from different areas of the brain. In support of this view, he notes that damage to specific areas of the brain does not necessarily lead to a universal collapse of mental functioning. Rather, some types of functioning may be affected while others remain intact (Gardner, 2020; Shearer, 2019).

> **theory of multiple intelligences** theory that there is no single, unified intelligence, but instead several independent intelligences arising from different portions of the brain.

Gardner's research regarding people of exceptional ability has also contributed to the notion of multiple and independent intelligences. Work with individuals with *savant syndrome*, for example, seems consistent with this view. Individuals with savant syndrome often score low, sometimes extremely low, on traditional intelligence tests, yet possess startling ability in a specific area. Some have little verbal ability but are able to compute numbers with the speed of a calculator, others can draw with great skill, and still others

have a keen memory for music. Stephen Wiltshire is a savant with autism who has phenomenal artistic skills. On YouTube, you can watch him draw a fully detailed picture to scale of 4 square miles (about 10 square kilometres) of Rome, Italy after observing it for the first time from a helicopter for just 45 minutes. Table 10.2 outlines the nine basic intelligences identified by Gardner: linguistic, logical-mathematical, musical, spatial, bodily kinesthetic, interpersonal, intrapersonal, naturalistic, and existentialist.

Although Gardner's theory has roots in Thurstone's ideas, it is, in fact, different from Thurstone's theory in several ways. First, Thurstone held that the mental functions he identified *collectively* constitute intelligence. He did not believe, as Gardner does, that each factor is itself an "intelligence." Further, Gardner believes that the various intelligences are best measured in the contexts in which they occur. Thus, assessments conducted in real-world settings where the intelligences they are trying to tap are actually used are more useful than paper-and-pencil examinations for assessing several of the intelligences (Tirri, Nokelainen, & Komulainen, 2013). Finally, Gardner's definition of multiple intelligences includes an important cultural component: each intelligence, he suggests, reflects "the ability to solve problems, or to create products, that are valuable within one or more cultural settings" (Gardner, 1993a).

Because the various intelligences are thought to emanate from different areas, or modules, of the brain, Gardner's theory is often called a *modular model* of mental functioning (Gardner, 2000, 1993a). Nevertheless, according to Gardner, the various intelligences can influence one another. For example, in addition to a well-developed musical intelligence, a cellist might need a high bodily kinesthetic intelligence to physically handle the instrument, and a high interpersonal intelligence to work in perfect harmony with other players in an orchestra.

TABLE 10.2

Gardner's Multiple Intelligences
Source: Based on Gardner, H. (2000). *Intelligence reframed: Multiple intelligences for the 21st century*. New York: Basic Books; Gardner, H. (1993). *Multiple intelligences: The theory in practice*. New York: Basic Books; Moran, S., Kornhaber, M., & Gardner, H. (2009). Orchestrating multiple intelligences. *Educational Leadership*, 64, (1), 22–27.

Type of Intelligence	Characteristics	Possible Vocations
Linguistic	Sensitivity to the sounds and meaning of words	Author, journalist, teacher, blogger
Logical/mathematical	Capacity for scientific analysis and logical and mathematical problem solving	Scientist, engineer, mathematician, video game developer
Musical	Sensitivity to sounds and rhythm; capacity for musical expression	Musician, composer, singer
Spatial	Ability to accurately perceive spatial relationships	Architect, navigator, sculptor, athlete

Bodily/kinesthetic	Ability to control body movements and manipulate objects	Athlete, dancer, surgeon
Interpersonal	Sensitivity to the emotions and motivations of others; skillful at managing others	Manager, therapist, teacher, Twitter influencer
Intrapersonal	Ability to understand one's self and one's strengths and weaknesses	Leader, or freelancer, in many fields
Naturalistic	Ability to understand patterns and processes in nature	Biologist, naturalist, ecologist, farmer
Existentialist	Ability to understand religious and spiritual ideals	Philosopher, religious scholars

Critics of Gardner's ideas, however, maintain that still deeper relationships exist among the various intelligences and mental functions. There is limited data supporting the existence of the distinct intelligences that Garner suggests (Glazzard, 2015; Gardner, 2016). Validating studies demonstrating that the different intelligences can be consistently and distinctly measured have yet to be accomplished (Ekinci, 2014). As well, when measured, most of Gardner's intelligences correlate positively with general intelligence measures, which calls into question just how distinct Gardner's intelligences are (Plucker & Esping, 2013). Not all human abilities have to be called intelligence.

Robert Sternberg's Triarchic Theory of Intelligence

Psychologist Robert Sternberg has proposed a **triarchic theory of intelligence** (Sternberg, 2010, 2018a). Sternberg shares Gardner's view that intelligence is not a unitary mental function. According to Sternberg, however, intelligence is made up of only three interacting components, as shown in **Figure 10.2**, called internal, external, and experiential components. These are sometimes referred to as the analytic, creative, and practical components.

> **triarchic theory of intelligence** Sternberg's theory that intelligence is made up of three interacting components: internal, external, and experiential components.

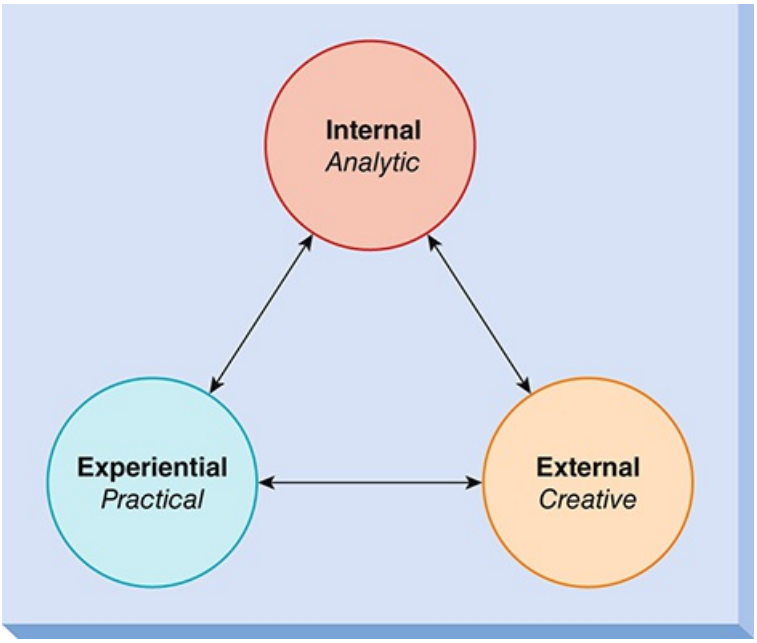


FIGURE 10.2 Sternberg's triarchic theory of intelligence Robert Sternberg proposes that there are three components to intelligence, not multiple independent ones. In his model, intelligence is related to the successful interaction among the internal (analytic), the external (creative), and the experiential (practical) components.

Internal (*analytic*) This component of intelligence relates to the internal processing of information: acquiring information; planning, monitoring, and evaluating problems; or carrying out directions. The internal aspect of intelligence is the one most often measured by today's intelligence tests—the sort of intelligence needed for straightforward tasks and problems that we confront at school or work or in life.

External (*creative*) Sternberg notes that some tasks are novel and so require a special way of thinking. Travelling to Cambodia for the first time, for example, requires more creative thinking than walking down a local street in your hometown. Among other things, travellers would have to figure out how to get through Cambodian customs, find their way to a hotel, and order meals in restaurants—all, perhaps, without knowing the language. This component of intelligence clearly requires creativity, and it also must interact with the internal component of intelligence to bring about successful results.

Experiential (*practical*) This type of thinking helps us adapt to or improve our environments or select new environments. Let's say you move into a new home and find that the neighbours make a lot of noise when you are trying to go to sleep. At first, you might try to solve the problem by moving to another bedroom in the house (adapting to the environment). If this doesn't work, you might try installing soundproof windows or complaining to the neighbours or to the landlord (changing the environment). And, finally, if that doesn't work, you might decide to move to another house (selecting a new environment).

Sternberg suggests that practical intelligence often relies on *tacit knowledge*, "action-

oriented knowledge, acquired without direct help from others, which allows individuals to achieve goals they personally value" (Sternberg et al., 1995, p. 916). A successful businessperson who earned only average grades in school has probably acquired considerable tacit knowledge, or "know-how," by working in the business environment and figuring out what is needed to get the work done. Not surprisingly, research shows that tacit knowledge is related to job success (Joia & Lemos, 2010; Sternberg, 2015).

Sternberg argues that effective interactions among the internal, external, and experiential components are keys to achieving successful intelligence—an advantageous balance between adapting to, shaping, and selecting problems encountered within one's environment (Sternberg, 2014). Because each intellectual component in Sternberg's theory actively relates to the others, his model is considered more dynamic, or interactive, than Gardner's. There is also more research evidence in support of Sternberg's theory. A number of studies have been able to measure and distinguish among the components of the triarchic theory of intelligence (Sternberg et al., 2001; Sternberg, 2018a).

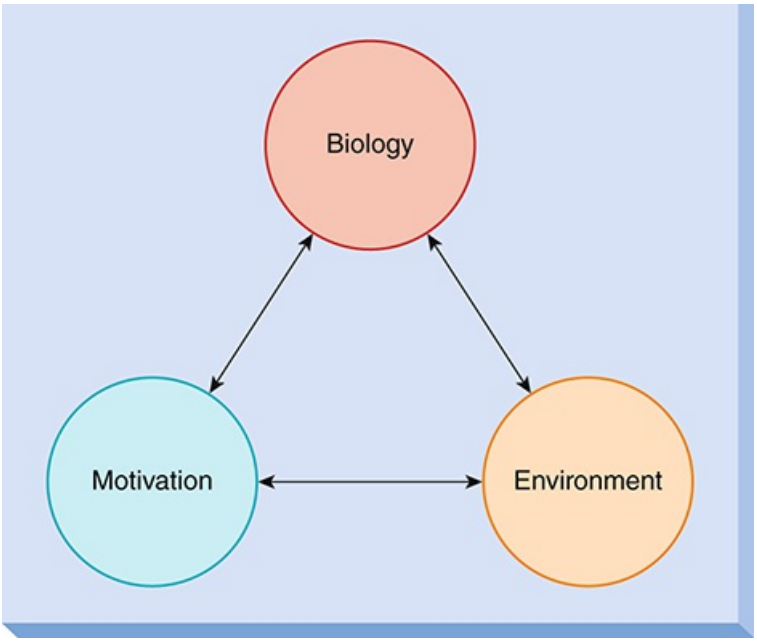


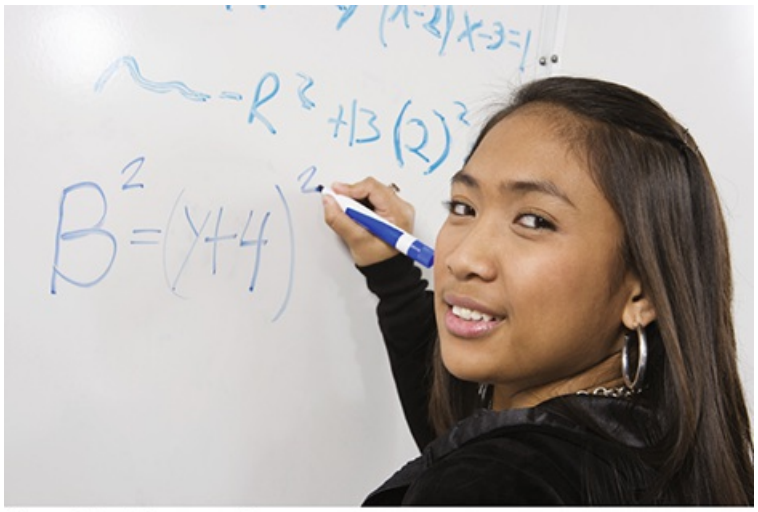
FIGURE 10.3 Ceci's bioecological model of intelligence Stephen Ceci proposes that intelligence is the product of interaction among biological, environmental, and motivational resources, and that each resource is responsible for a different aspect of intelligence.

Stephen Ceci's Bioecological Theory of Intelligence

The **bioecological model of intelligence**, proposed by Stephen Ceci, adds to our current models of intelligence by hypothesizing that intelligence is "a function of the interactions between innate potential abilities, environmental context (ecology), and internal motivation" (see **Figure 10.3**) (Barnett & Ceci, 2005; Ceci, Williams-Ceci, & Williams, 2016). According to Ceci, each person's innate abilities derive from a system of biological factors, or "resource pools." These resource pools are independent of each other, and each is responsible for different aspects of one's information-processing capabilities. Ceci claims

that a person's innate abilities will develop based more or less on how they interact with the individual's environmental resources, or context.

bioecological model of intelligence Ceci's theory that intelligence is a function of the interactions among innate potential abilities, environmental context, and internal motivation.



sirtravelalot/Shutterstock.com

Innate abilities and environmental resources **According to Ceci, a person's innate abilities develop based on how they interact with environmental resources. For example, this girl's potential to do well in math could be developed based on her access to a computer or enrollment in special math enrichment classes, and this encouraging environment would likely lead to further success in math.**

Consider, for example, a child whose biological resource pool endows her with the potential to succeed in math. Her abilities might lead to early successes in arithmetic, prompting her parents to provide environmental changes—her own computer, special enrichment opportunities in math, and so forth—that will help her to further develop her innate math potential. This encouraging environmental context will likely lead to further successes, which in turn may lead to additional environmental changes, such as enrollment in a special school. On the other hand, her context might not be supportive of her developing her superior talents. Our society's negative stereotype about math abilities in girls—"girls can't do math"—can decrease their interest in math and influence performance on tests of math skills (Shapiro & Williams, 2012). (See photo.)

Finally, according to the bioecological model, individuals must be internally *motivated* to fulfill their innate abilities and take advantage of their particular environments. When people feel motivated in certain areas, they tend to focus on their intellectual skills in those areas and to seek out environmental resources that are relevant. In an interesting study, Ceci found that men who were successful at race track betting, and who produced complicated strategies for predicting winning horses, did not demonstrate sophisticated thinking in other areas of intellectual ability (Ceci & Liker, 1986). These men were *motivated* to win serious money at the race track, and developed complex intellectual

processing and personal environmental opportunities (expertise) that might lead to that particular result (Detterman, 2014).

Where Are We Today?

Many theories on the nature of intelligence have been proposed and investigated but is there a basic view upon which today's scientists agree? It is fair to say that the majority believe that intelligence *includes* a *g* factor—an overriding intellectual ability (Hunt, 2010; Lang, Kersting, & Beauducel, 2016). However, few current theorists believe that the *g* factor is the best theory of intelligence. Most consider specific abilities (verbal, numerical, spatial skills, for example) and special factors (motivation, context, experience, and the like) to also be important in the expression of intelligence. The *g* factor is at work in every task that we confront in life, while the specific abilities and special factors come into play for some tasks but not others. This prevailing view is called a *hierarchical model* of intelligence (Bornstein & Putnik, 2019; Castejon et al., 2010).

Because the *g* factor seems to play a role across all kinds of tasks, it is, of course, desirable to have a high degree of general intelligence. But the *g* factor alone will not consistently lead to outstanding performances or successes in school, work, or other areas of life. Similarly, verbal ability, high motivation, or proper environment alone rarely guarantees high intellectual achievement. Intelligence truly appears to be a complex, multifaceted phenomenon.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

1. Identify and define the two factors in Spearman's model of intelligence.

2. How does Thurstone's theory of primary mental abilities differ from Gardner's theory of multiple intelligences?

3. Name four of Gardner's intelligences. What are some of the concerns about Gardner's definition of intelligence(s)?

4. What are the three components of the triarchic theory of intelligence, and how do they contribute to mental functioning?

5. What are the main features that interact to produce intelligence in Ceci's theory?

What Do You Think? • How would you define intelligence? Apply one or two of the theories to yourself and to one or two other people you know well. Do the theories fit with your general assumptions about intelligence?

How Do We Measure Intelligence?

LEARNING OBJECTIVE 2

Identify important considerations in the construction of intelligence tests, discuss the history of intelligence testing, and describe some criticisms of intelligence tests.

For better or for worse, the history of intelligence theory is completely intertwined with the history of intelligence testing. Both the theories psychologists propose and the tests they devise affect how they understand intelligence. Researchers and statisticians first fashioned standardized tests and statistical methods with which to assess intelligence in the late 1800s and early 1900s. In the West, one of the oldest and most enduring approaches to understanding and assessing intelligence is the psychometric approach. The **psychometric approach** attempts to measure intelligence with carefully constructed psychological tests, called *intelligence tests*. The psychometric approach is also used to construct measures for other human individual difference dimensions, such as personality and a variety of human resources management and talent development areas (Gregory, 2014; Mehdiabadi & Li, 2016).

psychometric approach an approach to defining intelligence that attempts to measure intelligence with carefully constructed psychological tests.

Before examining in detail some of the ways people have measured intelligence throughout history, it's worthwhile to think about what qualities make a good intelligence test. Knowing how psychologists build and use intelligence tests will help you figure out what these tests mean. Keep in mind, though, that how we think about intelligence today is based on the insights and mistakes of earlier theorists and researchers.

Intelligence Test Construction and Interpretation

Intelligence test constructors typically assume a comparative view of test scores; they usually measure intelligence by comparing one person's test scores with another's. However, there is no absolute or independent standard of intelligence against which to compare intelligence test scores (i.e., while you can know with certainty the balance in your bank account, we can never know with the same certainty what a person's intelligence is). The use of this comparative approach gives rise to a number of cautions or limits on how we think about and use intelligence measures. First, a test must function the same in different groups of people (so that individuals do not get different scores just because they are from different ethnic groups, different genders, or different parts of the country). Second, similar items on a test must relate both to one another and to the material of interest (i.e., if you excel at reading comprehension tests, all of the questions on a test assessing this ability should show similar results: that you excel at reading comprehension). To ensure that intelligence tests are grounded in sound scientific principles, psychologists design tests that adhere to three basic criteria: reliability, validity, and standardization (Gregory, 2014; Kaufman, Raiford, & Coalson, 2015).

Reliability

The first criterion of well designed intelligence tests is that they have **reliability**. A test is reliable when it consistently produces similar scores for the same test-takers over time. For example, as an adult your scores on a test of intelligence will likely be the same in your 20s,

30s, and 40s, assuming your environment stays relatively stable. We'll come back to the role of environment later in this chapter. Psychologists have developed several ways to show that a test is reliable. One approach, called *test-retest reliability*, involves administering the test once and then a second time. If the scores on the two administrations agree for each individual, they are said to correlate highly, and the test is considered to be reliable. Another approach, *split-half reliability*, is to divide the items on a single test into two tests, and see whether each individual's scores on the two halves of the test correlate highly. Whatever the approach used, the higher the statistical correlation between scores, the greater the reliability. Remember from Chapter 2 that a correlation can vary from a value of +1.00 to −1.00. To be reliable, a test must produce very similar results when administered to the same people within a short period of time (so that we can assume little has changed between testing sessions). A correlation between the first and second test administration scores that is up near +1.00 indicates that the test is stable or *reliable*.

reliability the degree to which a test produces the same scores over time.

lisafx/Getty Images

Content validity A driving test that measures the learner's understanding of the rules of the road and other relevant information has high content validity.

Validity

A test with a high degree of reliability does not necessarily have high validity. **Validity** is the extent to which a test accurately measures or predicts what it is supposed to measure or predict. Suppose we use a broken scale, which adds 5 kilograms or 11 pounds to each individual, to weigh the residents of a town and we weigh each resident multiple times. Assuming that, for each person, the scale repeatedly yields the same weight, the resulting weights would be said to have a high degree of reliability. The results, however, while reliable, would have low validity because the weights collected by using the broken scale are not accurate.

validity the extent to which a test accurately measures or predicts what it is supposed to measure or predict.

How can we determine the validity, or accuracy, of a test? Often we can simply look at the test content. If you were to administer a test on Chinese grammar to assess students' mastery of French, the test would not demonstrate much **content validity**. By contrast, if you were taking driving lessons and your instructor tested you on your understanding of the rules of the road and other kinds of relevant information, the test would demonstrate high content validity (see photo).

content validity the degree to which the content of a test accurately represents what the test is intended to measure.

We can also assess the validity of tests by correlating test scores with an external criterion that we have some confidence in—a correlation called a **validity coefficient**. If, for example, we believe that intelligent people will perform better at school (because of their higher intelligence), then we expect individuals' scores on an intelligence test to correlate with their school grades. If this is true then the validity coefficient will be higher, and the test will be considered more valid. A test can also predict future performance. When high scores on an intelligence test a person takes in elementary school successfully predict high grades in high school, it is said to display high **predictive validity** (Gow et al., 2011; American Educational Research Association, 2014). When assessments are used as part of recruitment and hiring processes, people's potential jobs are at stake and the assessments used had better be reliable and valid. To find out about how industrial/organizational psychologists ethically utilize tests in their research and practice check out the Psychology@Work video on Individual Assessment.

validity coefficient a correlation coefficient that measures validity by correlating a test score with some external criterion.

predictive validity the extent to which scores on a particular test successfully predict future performance on a measure related to the test.

Standardization

If you were the only person taking a particular intelligence test, your score would mean very little. For your score to have meaning, it is compared with the scores of people who have already taken the same test. This group of people is referred to as a normative *sample* (Refer back to Chapter 2 if you need a refresher on psychological methods and statistics.) If all subsequent test-takers follow the same procedures as those used when collecting data from the normative sample, then each individual's test score can be compared with the scores of the normative sample. The process of obtaining meaningful test scores from a normative sample through the use of uniform procedures is called **standardization**. Once a test has been standardized, the scores of subsequent individuals who take the test can be compared to the standardized test norms.

standardization the use of uniform procedures in administering and scoring a test.

Video **PSYCHOLOGY@WORK**

Individual Assessment This video looks at what industrial/organizational psychologists assess or measure and then talks about the vital and ethical importance of understanding reliability and validity in relation to the results obtained from using measures to help decide who gets a job or who gets promoted.

Test results from large populations tend to follow particular patterns, called *distributions*. Scores on intelligence tests follow a **normal distribution** (or *normal curve*), a statistical pattern in which most people achieve fairly similar scores at or near the middle of the distribution, or within one standard deviation of the mean, which represents 68 percent of the population, while a small number earn low scores and an equally small number earn high scores; these individuals fall either below or above 2 standard deviations from the mean of 100 and represent only 5 percent of the population. In graph form, this normal distribution forms a bell-shaped pattern, often called a *bell curve* (see **Figure 10.4**).

normal distribution a symmetrical, bell-shaped distribution in which most scores are in the middle, with smaller groups of equal size at either end.

In a normal distribution, the scores of most people fall in the vicinity of the **median** score (that is, the middle score). The scores that are higher or lower than the median keep declining in number as the scores extend farther and farther from the median. The very lowest and the very highest scores are found at the outer edges of the bell curve. The median score is one indicator of a population's central tendencies. Others include the **mean**, or the average score, and the **mode**, the score that occurs most frequently in the population. In the case of the normal distribution, or bell curve shown in **Figure 10.4**, the median, mean, and mode should be the same.

median the score exactly in the middle of a distribution.

mean the average score in a distribution.

mode the score that occurs most frequently in a distribution.

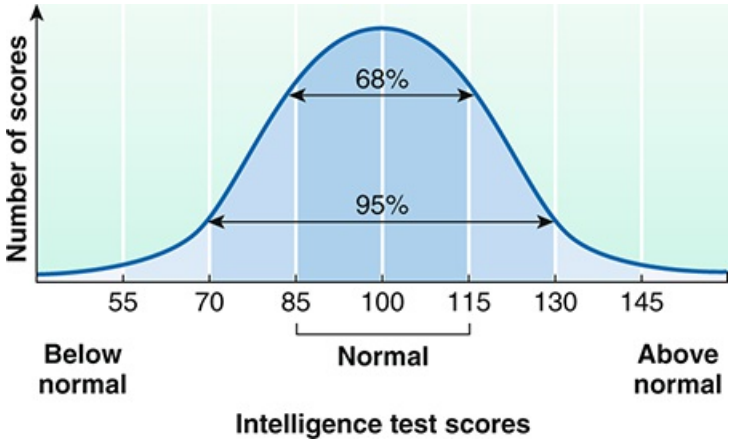


FIGURE 10.4 The bell curve of intelligence scores **The distribution of scores on intelligence tests follows a statistical pattern called the bell curve. Most peoples' scores fall in the middle range, with a small number scoring at the extreme ends.**

History of Intelligence Testing

The first systematic attempts to measure intelligence were developed during the second half of the nineteenth century. The most influential approaches were those of Francis Galton in England and Alfred Binet in France. Later, in the United States, Lewis Terman and David Wechsler also made important contributions designing tests for measuring intelligence.

Alfred Binet and the Binet-Simon Intelligence Test

In 1904, the French government mandated compulsory education, and the Minister of Public Instruction in Paris formed a commission to devise a way to distinguish children with intellectual disabilities from those who were unsuccessful in school for other reasons, such as behavioural problems. The idea was to assign intellectually capable children to regular classes and place those with intellectual disabilities in special classes. To help determine the most appropriate type of class for each child, Alfred Binet (1857–1911; see photo) Binet and Théodore Simon (1873–1961) devised the first widely applied intelligence tests (Hunt, 2010).

Bettmann/Getty Images

Intelligence testing pioneers Alfred Binet (pictured) and Théodore Simon developed the first standardized intelligence test. The test was used to sort new arrivals into the Paris school system following the passage of mandatory school attendance laws.

Binet saw that the basis of intelligence is "judgment, otherwise called good sense, practical sense, initiative, the faculty of adapting one's self to circumstances. To judge well, to comprehend well, to reason well, these are the essential activities of intelligence." In short, Binet viewed intelligence as the "ability to demonstrate memory, judgment, reasoning, and social comprehension" (Kaufman, 2000, p. 446).

The tasks on Binet's intelligence test focused largely on language abilities. Binet introduced the idea of mental age, the intellectual age at which a child is actually functioning. **Mental age** does not necessarily match chronological age. A child's mental age is indicated by the chronological age typically associated with his level of intellectual performance. Thus, the typical 11-year-old has a mental age of 11. A more intelligent 11-year-old, however, might have a mental age of 13, while a less intelligent 11-year-old might have a mental age of 9.

> **mental age** the intellectual age at which a person is functioning, as opposed to chronological age.

Binet did not believe his intelligence test necessarily measured a child's *inborn* level of intelligence. His goal was simply to predict a student's likelihood of success in school. And, in fact, he did find a moderate correlation between performance on his test and performance in school. The test also correlated with scores on *achievement tests*—tests of knowledge about particular school subjects—although at a lower magnitude.

It is worth noting that Binet refused to use test scores to rank children. He felt that intelligence is too complex a phenomenon to draw meaningful conclusions about the *relative* intelligence among most children. He argued that it would be unfair to say that one child of average intelligence, as measured by his test, was more intelligent than another

child of average intelligence. However, Binet's concerns did not stop others from extending his test in ways that he neither anticipated nor advocated.

Galton and "Psychophysical Performance"

While Alfred Binet and Théodore Simon were creating tests in France to assess the intellectual performance of children as a way to determine preparedness for school, Francis Galton (1822-1911) sought to apply his half-cousin Charles Darwin's ideas about evolution to the study of intelligence. He believed that by studying intellectual development, he could learn more about the evolution of the human species in general, and the inheritance of intelligence in particular (Hunt, 2010). In particular, Galton sought to understand why some people appear to be more intelligent than others. If he could understand the evolutionary factors at work in such differences, he reasoned, steps could be taken to improve the species.

Galton, who believed in a general intelligence factor, proposed that two qualities distinguish more gifted from less gifted people: a kind of psychic energy and a heightened sensitivity to external stimuli. His theory, termed the *theory of psychophysical performance*, held that people with more energy can perform more work and, in turn, develop greater intelligence. In addition, individuals who have more highly developed senses can take in more information (Naglieri, 2015). To more accurately gauge intelligence, Galton developed tests of an individual's sensory processing, motor skills, and reaction time.

Galton's work influenced many theorists. James McKean Cattell one of the first psychology professors in the United States, later designed 50 psychophysical tests, expecting that the tests would support and extend Galton's ideas. Cattell tested skills, such as how fast people can move their arm over a specified distance and how many letters in a series they can remember. Ironically, Cattell's tests eventually helped to discredit Galton's notions by supporting the idea that there is more than one general form of intelligence (Sokal, 2010).

In his doctoral dissertation, one of Cattell's students, Clark Wissler, hypothesized that people would perform consistently well or consistently poorly across the various psychophysical tests, and that those who did consistently well would display a higher level of general intelligence than those who performed poorly (Wissler, 1961). However, Wissler found that a given person's various test performances did not necessarily correlate either with each other or with academic performance. To determine whether each research participant's performances on various psychophysical tests were in fact correlated, Wissler used *correlation coefficients*—a statistical method developed by Galton. Thus, Galton's own statistical tool was eventually used to challenge and refute his theory.

Lewis Terman and the Stanford-Binet Intelligence Test

Interest in the work on intelligence testing in Europe spread throughout the world, and Stanford University professor Lewis Terman (1877–1956) adapted the Binet-Simon intelligence test for use in the United States. He realized that some of the test items, originally developed to test French children, needed to be changed to better assess the intelligence of children in the United States. The age norms, for example, did not apply to the American school children in Terman's sample. This was an important early recognition of the influence of culture in intelligence testing. Terman called his new test the Stanford-Binet Intelligence Test (Antonson, 2010; Goodwin, 2015).

Mark Humphrey/AP Images

A high IQ Michael Kearney (centre) graduated high school at 6 years of age, received his first degree (a Bachelor's degree in Anthropology) at age 10, and received his master's degree in chemistry at age 14.

In developing his version of Binet's test, Terman decided to state the results not simply in terms of mental age, but as a measure that would relate mental to chronological age. Thus, the famous **intelligence quotient**, or **IQ**, was devised. To arrive at this measure of intelligence, Terman calculated the ratio of mental age to chronological age and multiplied that ratio by 100 (to remove the decimal point). Thus, returning to our earlier examples, the 11-year-old with average intelligence would earn an IQ of 100 (11/11 × 100), a more intelligent child would post an IQ of 118 (13/11 × 100) (see photo), and a less intelligent child's IQ would be 82 (9/11 × 100).

> **intelligence quotient (IQ)** Terman's measure of intelligence; the ratio of a child's mental age to her chronological age, multiplied by 100.

In addition to adapting Binet's test for use in American schools, Terman had a larger goal—likely influenced by the work of Galton in England, who was looking for the evolutionary basis of intelligence—a goal that today is considered reprehensible. He was an advocate of the nineteenth century *eugenics movement*, which sought to discourage people deemed as "unfit" from reproducing, while encouraging "fit" individuals to have children (Leonard, 2016). He believed that his IQ test could help determine the "fitness" of individuals to reproduce. He stated, "[T]he children of successful and cultured parents test higher than children from wretched and ignorant homes for the simple reason that their heredity is better." More generally, Terman believed that his test demonstrated that some groups of people are inherently less intelligent than others (Hegarty, 2007; Feldhusen, 2003).

Working with agencies in the United States government, Terman also administered his test

to newly arrived immigrants, to determine whether they should be admitted to the United States, and to almost two million World War I army recruits, to determine their fitness for the military. The mass testing of immigrants helped lead to a 1924 law that greatly lowered the number of people allowed to enter the United States from Southern and Eastern Europe, while increasing the number from Northern and Western Europe. This is a vivid example of how non-scientific thinking (such as prejudice and racism) can influence scientific thinking and political decision making. Despite such misuse of the early Stanford-Binet test, it remained for many years the leading intelligence testing instrument in the United States and Canada.

David Wechsler and the WAIS

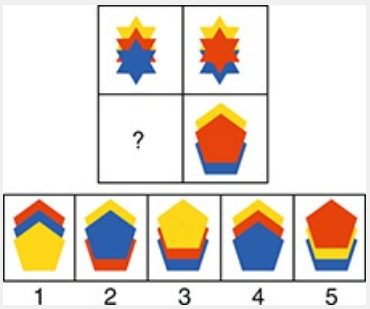
As a young man inducted into the army during World War I, David Wechsler (1896–1981) was trained to administer and score the Stanford-Binet and other intelligence tests of the time. Over the course of his work, he came to recognize two key problems with the tests (Kaufman A.S., 2000; Kaufman J.C., 2009).

First, he realized that the distinction between mental and chronological age becomes less informative when testing adults. While it may be true that a considerable difference in intelligence may be evident between an 8-year-old and a 13-year-old, a five-year difference between adults tends to be meaningless. How much difference is there, for example, between the mental ability of a typical 30-year-old and a typical 35-year-old? Not much. Second, Wechsler, who was born in Romania and whose family immigrated to the United States when he was 6 years old, recognized the need for greater fairness when testing people who did not speak English or who spoke it poorly.

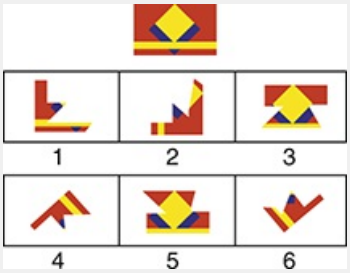
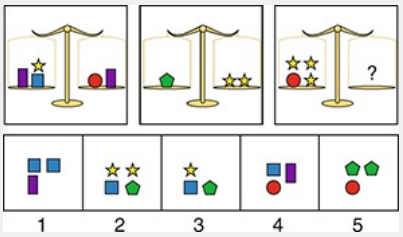
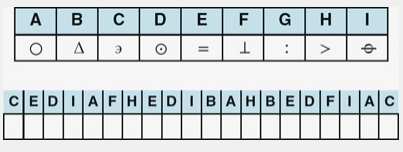
Over the course of his professional life, Wechsler devised a number of intelligence tests that took such problems into account. The first such test—the *Wechsler-Bellevue Intelligence Scale*—was published in 1939. Different versions of Wechsler's tests continue to be published by his associates to the present day (Watkins, 2010; Hartman, 2009; Tobin, 2013). The best known of these tests are the *Wechsler Adult Intelligence Scale* (*WAIS*) and the *Wechsler Intelligence Scale for Children* (*WISC*). **Figure 10.5** shows sample items from the WAIS.

Wechsler Adult Intelligence Scales (WAIS)–IV [CDN] Subtests Grouped According to Index Scores

	Subtest	Description	Example
Verbal Comprehension	Vocabulary	Test ability to define increasingly difficult words	What does repudiate mean?
	Similarities	Asks in what way certain objects or concepts are similar; measures abstract thinking	How are a calculator and a typewriter alike?
	Information	Taps a general range of information	On which continent is France?

	Comprehension	Tests understanding of social conventions and ability to evaluate past experience	Why do people need birth certificates?
Verbal IQ			
Working Memory	Arithmetic	Tests arithmetic reasoning through word problems	How many hours will it take to drive 150 kilometres at 50 kilometres per hour?
	Digit Span	Tests attention and rote memory by orally presenting series of digits to be repeated forward or backward	Repeat the following numbers backward: 2 4 3 5 1 8 6
	Letter-Number Sequencing	Tests attention, concentration, mental control	For each item, repeat the numbers first in ascending order then the letters in alphabetical order (or the letters then the numbers).
Performance IQ			
Perceptual Reasoning	Block Design	Tests ability to perceive and analyze patterns by presenting designs that must be copied with blocks	Assemble blocks to match this design:
	Matrix Reasoning	Tests non-verbal abstract problem solving, inductive reasoning, and spatial reasoning	Which image goes in the empty box? 

Item	Trial	Correct Response	
1.	T-4-L-5-Z-2-H	2-4-5-H-L-T-Z	H-L-T-Z-2-4-5
2.	6-R-9-J-1-S-5	1-5-6-9-J-R-S	J-R-S-1-5-6-9
3.	M-1-K-5-R-2-H	1-2-5-H-K-M-R	H-K-M-R-1-2-5

	Visual Puzzles	Tests spatial reasoning	Which three of these pieces go together to make this puzzle? 
	Picture Completion	Tests ability to quickly perceive visual details	What is missing in this picture?
	Figure Weights	Tests quantitative and analogical reasoning	Which one of these goes here to balance the scale? 
Processing Speed	Coding	Tests visual-motor coordination, motor and mental speed, visual working memory	Fill in the empty boxes with the shapes you see here. 
	Symbol Search	Tests visual perception/ analysis, scanning speed	For each set below, indicate whether the symbol in the black box is contained in the

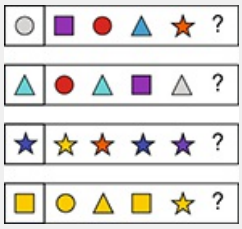
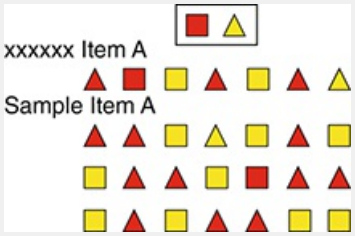
			set of symbols to the right. 
	Cancellation	Tests visual-perceptual speed	When I say go, draw a line through each *red* square and *yellow* triangle. 

FIGURE 10.5 Items similar to those on the WAIS The widely used WAIS gives separate scores for Verbal Comprehension, Working Memory, Perceptual Reasoning, and Processing Speed, as well as an overall intelligence score.

Source: Sample items similar to those found in the Wechsler Adult Intelligence Scale, Third Edition (WAIS-III). Copyright © 1997 NCS Pearson, Inc. Reproduced with permission. All rights reserved. "Wechsler Adult Intelligence Scale" and "WAIS" are trademarks, in the US and or other countries, of Pearson Education, Inc. or its affiliates. Illustrations taken from http://images.pearsonclinical.com/images/assets/WAIS-IV/WAISIV2_6_08.pdf.

Selected answers: Matrix Reasoning: 4 is correct; Visual Puzzles: panels 1, 3, and 6 make up the sample figure; Picture Completion: The heel of the shoe on the woman's raised foot is missing; Figure Weights: choice 2 is correct.

Wechsler borrowed much from the Stanford-Binet and other tests; however, his tests were less dominated by tasks requiring verbal ability. There are 15 subtests on the current fourth (Canadian) edition of the WAIS (Wechsler, 2014). They are divided into four scales: Verbal Comprehension, Working Memory, Perceptual Reasoning, and Processing Speed. Figure 10.5 shows the specific scales that make up each index. Individuals who take the test receive a score on each scale. Individuals also receive an overall score that Wechsler associated with the *g* factor. In addition, Wechsler discarded the old formula for calculating an *IQ* score. Although he still called a person's overall score an *intelligence quotient*, or *IQ*, he derived the score from a normal distribution or standardized set of scores (discussed earlier in this chapter), rather than from a ratio. Essentially, he would compare individual scores to scores obtained over a very large sample of individuals. Using the normal distribution, Wechsler could see how much individual scores differed from or deviated

from (were higher or lower than) the general estimate of the population average. This method for IQ score generation has been adopted by the majority of other intelligence tests.

Wechsler's tests resulted from his clinical experience, not from a clear theoretical position. However, he did develop a broad view of what intelligence means. He believed that it is more than success on test scores. To him, intelligence is at work as individuals try to manage the day-to-day aspects of life, interact with others, and perform at work. Wechsler's broad view of intelligence has gained momentum over the years. Indeed, as we suggested earlier, it lies at the centre of most current theories of intelligence (Boake, 2002).

How Well Do Intelligence Tests Predict Performance?

The Stanford-Binet and the WAIS have very high degrees of reliability (Hunt, 2010). The correlation coefficient for retakes of each test is about +.90. Furthermore, repeated measurements of IQ across the lifespan tend to correlate very highly (Gow et al., 2011; Lyons et al., 2017). Today's leading intelligence tests are also highly correlated with school performance—a validity coefficient of about +.50 (Lynn & Meisenberg, 2010; Sternberg, 2018a). The correlations are even higher between IQ scores and the number of years of schooling that people complete (Ritchie et al., 2013). These findings are especially relevant considering that IQ tests were originally designed to assess for school performance.

Of course, IQ tests are meant to do more than predict school (or preschool!) performance. When we talk about IQ we often think about it in terms of defining general mental ability. After all, we continue to measure IQ for adults far past school age. This is so even though most of the tasks on any IQ test relate most strongly to school performance. Although these tasks are highly relevant to the types of challenges encountered in school—math, store of knowledge, reasoning—it is unclear to what degree they measure the many other types of intelligence that we describe in this and other chapters. For example, Keith Stanovich at the University of Toronto has argued that IQ does not predict rational thinking such as that reflected in the Nobel Prize-winning work of Daniel Kahneman and Amos Tversky (Stanovich & West, 2014).

So what does IQ mean outside the classroom? Performance on intelligence tests correlates to some degree with other areas of functioning in life, such as occupational and social achievements, income, and health-related behaviours (Hunt, 2010; Cramond, Kim, & VanTassel-Baska, 2010; Nisbett et al., 2012). In a massive undertaking, researchers administered the same intelligence test to every 11-year-old child in Scotland in 1932 and 1947, and then followed the children's development and achievements as they moved through the lifespan (Deary, Pattie, & Starr, 2013). Performance on an IQ test at this young age was found to correlate to some degree with better health throughout life, greater independence during old age, and a longer lifespan. It appears that IQ testing does have some relevance beyond the school ages. However, it is important to remember that these relationships are *correlational*. We do not know that higher intelligence *caused* any of these outcomes.

Cultural Bias and Stereotypes in Intelligence Testing

Though widely used and respected, intelligence tests are subject to many criticisms, both fair and unfair. One set of concerns involves *cultural bias* (Saklofske, 2015; Kan et al., 2013).

As mentioned earlier, different cultures may have different ideas of intelligence. For example, Western intelligence tests emphasize abilities such as logic, mathematical skill, and verbal fluency. They do not emphasize abilities such as getting along with others and fitting in with one's environment that would be considered important components of Chinese notions of intelligence. Such differences make comparing intelligence across cultures challenging (See Psychology Around Us 10.1 for further discussion of various types of intelligence).

10.1 Psychology Around Us

Fluid vs. Crystallized Intelligence

What do you think about when asked what intelligence is? When many people think about intelligence, they often think of IQ tests. While they can be useful, IQ tests by themselves are a blunt tool to establish a person's intelligence and in the last 60 years a great deal of work has been done to identify other aspects of intelligence, beside cognitive intelligence. In 1963, a psychologist named Raymond Cattell identified "fluid intelligence" and later, while working with John L. Horn, developed a theory that posited two distinct types of intelligence that are critical to our understanding of what intelligence is. The theory of fluid intelligence and crystallized intelligence was born (Horn & Cattell, 1966; Horn, 1988).

Fluid intelligence involves dynamic problem-solving abilities independent of previously acquired knowledge. It involves using logic to identify patterns and underlying relationships to help solve unique and novel problems. An example of fluid intelligence would be solving a lateral-thinking puzzle, where solving the puzzle doesn't involve a straightforward step-by-step process but rather thinking "outside the box." One example of fluid intelligence is the intellect involved in winning video games. Most video games require fluid intelligence to solve the challenges presented to the players, like managing in-game resources in a way that provides maximum benefit to the player.

Crystallized intelligence, conversely, requires an understanding of cultural values and pre-existing knowledge of a subject, or the world in general. Essentially, crystallized intelligence is the ability to make use of acquired information or knowledge to solve a problem using known facts and experience. Examples of this are remembering a math formula that's required to calculate the percentage of one number in relation to the other or knowing who scored the winning goal in the Stanley Cup final last year. Crystallized intelligence is something that tends to improve over time as people age and gain more knowledge and experience.

A great example of the interaction and interdependence of fluid and crystallized intelligence can be found in the popular videogame, Minecraft. In Minecraft, the necessary combinations and basic controls to play the game are all examples of crystallized intelligence, whereas the building of worlds, cities, and areas are examples of fluid intelligence. Another popular game, Fortnite, has a similar combination of fluid and crystallized processing. The controls needed to build, fire your weapon, and move around the map are all examples of crystallized intelligence, whereas the process of

hunting enemies and staying safe requires a dynamic approach that represents fluid intelligence. Playing these games involves both types of intelligence, which begs the question of whether playing video games can improve one's fluid and/or crystallized intelligence.

When looking at whether or not fluid and crystallized intelligence are immutable, Canadian researchers Mathilde Neugnot-Cerioli, Charlotte Gagner, and Miriam H. Beauchamp (2017) studied the ability of below-average IQ adolescents, using standard measures of IQ, to improve one of these two types of intelligence using commercially available games. Their findings suggest that both fluid and crystallized intelligence can be improved using these simple games. While it is commonly thought that crystallized and fluid intelligence deteriorate with age, Park and Bischof (2013) have found that engagement in activities that require sustained cognitive effort may actually improve fluid intelligence as the body ages. These findings suggest that intelligence is not necessarily set, with improvements possible throughout life.

M4OS Photos/Alamy Stock Photo

Success in video games An image from the game Minecraft where players can build worlds in any way they can imagine. To be successful, the use of both crystalized and fluid intelligence is important.

Challenges are not limited to comparing people from different countries, but extend to comparing members of different subcultures within a single country. For example, although Wechsler made considerable efforts to standardize the WAIS and make it as unbiased as possible, critics noted several curious oversights in earlier versions of the test. Many of its problem-solving questions reflected learning experiences and opportunities more commonly encountered in middle-class settings. For instance, the quality of the education experiences provided to middle-class children is higher, and they acquire vocabularies at home and school that are more representative of the vocabulary skills assumed by intelligence test developers (Hunt, 2010; Nicpon, 2014). In addition, until the most recent revisions of the WAIS, every time a picture of a person was used for a test item, the picture was of a Caucasian person.

Concerns about race- or culture-specific biases in intelligence tests are based on the idea that questions on intelligence tests presume that the people taking the test have had at least some opportunity to acquire the knowledge or skills required to answer the questions correctly. As a result, more intelligent people will answer more questions correctly. The privilege associated with one group, such as being white in the 1960s and 70s, also provides an inequitable advantage on intelligence tests that was less available to African Americans during this time, and arguably still today (Steinberg et al., 2004; Jencks & Phillips, 1998). In part to point out the culture-specific nature of intelligence testing Laundra and Sutton (2008) created a teaching tool to help us see the potential biases in questions tied to specific, differently privileged perspectives. The "You Think You Know Ghetto?" test (see sample items in **Table 10.3**) helps us to clearly see that all intelligence tests are grounded in particular cultural (and historical) perspectives. It is likely that there will always be culture-based disagreements about intelligence tests and about what knowledge and skills are important when measuring intelligence.

TABLE 10.3

Sample Items from the You Think You Know Ghetto Test

Instructions: Choose the best possible answer for each question. Once you have completed the test, review the correct answers provided. Did you score better or worse than others of your same racial/ethnic background? What other factors besides race may have played a role in these divergent scores? Are these differences important for measuring academic intelligence?

1. Translate this phrase: "Jet to the Jects."

- **(a)** Run home
- **(b)** Walk to the store
- **(c)** Go to the house of your significant other
- **(d)** Go to the projects

2. What is a "cuddy buddy"?

- **(a)** A person you skip school with
- **(b)** A Cadillac
- **(c)** A friend with whom you also have sex with
- **(d)** Your next door neighbor

3. What is "cakin it"?

- **(a)** Arguing
- **(b)** Making cornbread
- **(c)** Being lovey-dovey with your boyfriend or girlfriend
- **(d)** Making pancakes

4. Which city did "jukin," also known as footwork, originate from?

(a) Chicago

(b) Atlanta

(c) New York

(d) LA

5. Who were the rappers involved in the first and most famous Rap rival?

(a) Jay-Z and Nas

(b) Ja Rule and DMX

(c) Biggie and Tupac

(d) Eminem and Benzino

6. Being "booed up" means that you are:

(a) Cool

(b) Spending time with your boyfriend or girlfriend

(c) Constipated

(d) Being ridiculed in public

Answer Key:

1. D **2.** C **3.** C **4.** A **5.** C. **6.** B

(From Laundra & Sutton, 2008)

Kenneth Laundra and Tracy Sutton "You Think You Know Ghetto? Contemporizing the Dove "Black IQ Test"" Teaching Sociology, Vol. 36, No. 4 (Oct., 2008), pp. 366–377. Used by permission.

Most people interested in the construction of intelligence tests have abandoned the idea of totally unbiased tests, and instead try to design tests that do not put particular cultures at an absolute disadvantage. The Progressive Matrices Test attempts to achieve this goal in part by emphasizing abstract, non-verbal skills, for example. However, there are still cultural and educational influences on scores for this measure (Nadler & Komorraju, 2016). As such, the test is acknowledged to not be culture-free, but it is somewhat more culture fair than other intelligence tests. **Figure 10.6** shows some sample items from that test.

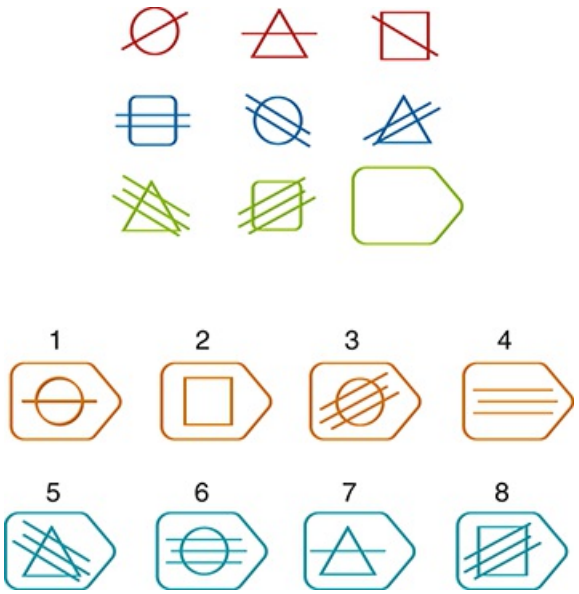


FIGURE 10.6 Item similar to the Progressive Matrices Test This test emphasizes abstract, non-verbal skills. Here the respondent chooses which of the numbered boxes below finishes the sequence above. (*Box #6 is the correct answer*.) Sample items similar to those found in Raven's Progressive Matrices (Advanced).

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A related testing issue involves **stereotype vulnerability or threat**, which occurs when people in a particular group perform poorly because they fear that their performance will conform to a negative stereotype associated with their group. Several studies have found that simply suggesting to students that they will not do well on a test because of their gender or race can lower their test scores (Owens & Massey, 2011; Massey & Owens, 2014).

stereotype vulnerability or threat a phenomenon in which people in a particular group perform poorly because they fear that their performance will conform to a negative stereotype associated with that group.

Researchers have used stereotype threat to manipulate the performance of Asian women on a math test (Ambady, Shih, Kim, & Pittinsky, 2001; Ambady et al., 2004; Shih, Pittinsky, & Ambady, 1999; Régner et al., 2014). Some participants were encouraged to focus on their female identity, and they tended to perform less well on the test (in keeping with the stereotype that women are not good at math). Other participants were encouraged to focus their attention on their Asian identity, and they tended to perform better (in keeping with the stereotype that Asians are good at math). Those given no encouragement to think about their gender or racial heritage still showed the above effects, depending on whether they were tested in a room with males (implicitly drawing attention to the females' gender) or with non-Asian students (implicitly drawing attention to their racial heritage). Finally, these effects were reduced if the participants read a prepared "scientific" article that stated

that the stereotypes (females bad at math and Asians good at math) were not true (Thoman et al., 2013, Régner et al., 2014). (See photo.)

yesfoto/Getty Images

The power of stereotype vulnerability or threat **In one study, Asian women who were encouraged to focus largely on their female identity performed poorly on a math test, while those who were led to focus on their Asian identity performed well on the math test.**

As psychologists' awareness and ability to detect bias grows, they are becoming increasingly able to construct tests that are more sensitive and more effective. We have, for example, already noted the efforts of developers of the WAIS to make their tests less culture-specific. Overall bias can be assessed both at the general level we have discussed here and also at a more detailed level. During test construction, today's tests are also assessed for *item bias*; if individuals from a particular gender or ethnic group miss an item with high frequency, that item is considered for elimination from the test. Similarly, certain questions may become less culturally relevant even for the majority culture over time and must be exchanged for questions that better reflect current conditions. It appears that ongoing efforts to assess and challenge these sorts of bias have been somewhat successful in rendering generally non-biased testing (Ford & Moore, 2013).

Is Human Intelligence Increasing?

The median score on intelligence tests, such as the Stanford-Binet and the WAIS, is set at 100. To keep the median score at 100, the tests periodically must be *restandardized*. People taking the WAIS today, for example, are taking a version that has been reconstructed—not the version that David Wechsler designed originally.

Upon reviewing test scores over time, researchers noticed something startling: intelligence

test scores from around the industrialized world seem to be increasing (Williams, 2013). Studies indicate that an average IQ score of 100 from 70 years ago would equate to a score of only 76 today. This puzzling phenomenon has been named the **Flynn effect**, after New Zealand researcher James Flynn (2007, 2013), who first discovered this effect in data from at least 14 nations (see **Figure 10.7**).

Flynn effect an observed rise in average IQ scores throughout the world over time.

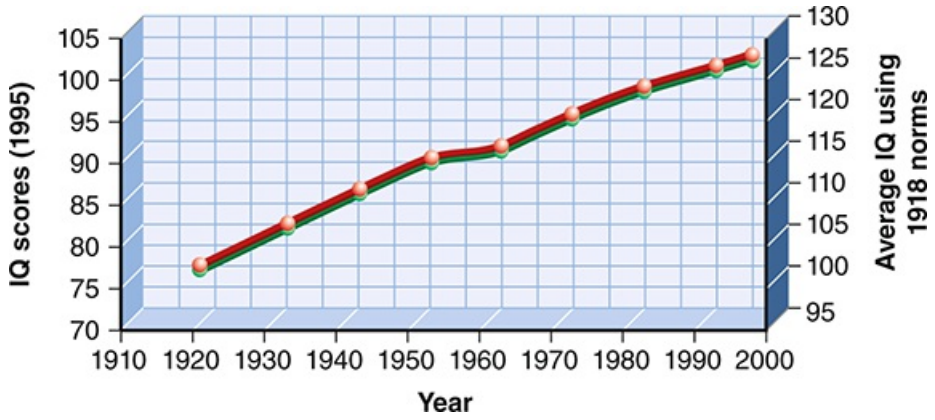

FIGURE 10.7 The Flynn effect Flynn demonstrated that intelligence scores have increased from 1918 to 1995. The right axis of the graph shows that if the 1918 scales were used today, the average IQ score in the United States would be 125. The left axis shows that if the 1995 scales were used, the average IQ score in 1918 would equate to a score of 76 today.

Source: Adapted from Weiten, W. (2007). *Psychology: Themes and variations* (7th ed.). Belmont, CA: Thomson Learning; Horgan, J. (1995). Get smart, take a test. *Scientific American*, 273(5), 1995, p. 14. Adapted with permission of Dmitry Schidlowsky Illustration.

Researchers do not fully understand why intelligence scores have increased over time (Pietschnig & Voracek, 2015; Ceci & Kanaya, 2010; Trahan, Stuebing, Fletcher, & Hiscock, 2014). One possibility is that there is something wrong with the basic procedures, content, or nature of standardized intelligence tests. A more widely embraced explanation holds that intelligence is changeable and that, on average, people today exhibit higher intelligence than people did in the past. Such improvements in intelligence might be related to improvements in education around the world, better nutrition, the development of more stimulating environments, reductions in childhood disease, or evolutionary shifts in genetic inheritance (Williams, 2013). It is also worth noting that some theorists believe that rising intelligence test performance is due to the greater test-writing sophistication and test-taking motivation of today's students (Sternberg, 2016b). Whether the Flynn effect continues to occur in the twenty-first century is debated and will remain to be seen (Rindermann, Becker, & Coyle, 2017).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

6. What three basic criteria are central to designing an intelligence test?

7. What was the original purpose of Binet's intelligence test? How did he measure intelligence?

8. How does mental age differ from chronological age?

9. How does Terman's definition of IQ differ from that of Wechsler?

10. What are the components of the WAIS and WISC intelligence tests? Give a couple of examples of what is measured on each component.

11. What are some of the ways in which intelligence tests have been shown to be culturally biased?

12. What does the concept of stereotype threat suggest about the situations in which people are tested?

13. What are some proposed causes of the Flynn effect?

What Do You Think? • How would you design a culture-free intelligence test?

Additional Types of Intelligence

LEARNING OBJECTIVE 3

Discuss several proposed types of intelligence that go beyond intellectual functioning.

The ideas and work that we have encountered so far consider a wide range of intellectual skills and methods for testing intelligence. But have they captured all aspects of intelligence? A growing number of theorists are focusing on the role of intelligence in emotions, social functioning, wisdom, creativity, and personality.

Emotional Intelligence

The concept of emotional intelligence is rather new—researchers began to actively study it in the 1990s. **Emotional intelligence** refers to an individual's ability to perceive, express, and assimilate emotion, and to regulate emotion in the self and others (Ackley, 2016; Cherniss, 2010; Roberts, McCann, Matthews, & Zeidner, 2010; Goleman, 2011). Emotionally intelligent people are thought to be self-aware, sensitive to how they feel and how their feelings change with different situations, and are able to manage their emotions so that they are not overwhelmed by them. People with well-developed emotional intelligence also tend to be empathic, knowing how to comfort and influence others via their emotional state (see photo). Not surprisingly, they often succeed in their careers and marriages, as parents, and as leaders (Kim & Kim, 2017; Brackett, Rivers, & Salovey, 2011).

emotional intelligence an individual's ability to perceive, express, assimilate, and regulate emotion.

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Emotional intelligence and acting **Successful actors are able to perceive and regulate emotions in themselves and in others, enabling them to portray a wide range of characters. Jim Carrey, for example, has an exceptionally broad range of facial and emotional expressions he can draw on while acting.**

If we grant the existence of emotional intelligence, then the question arises: can it be measured? In fact, researchers have devised a number of ways to measure it (Higgs & Dulewicz, 2016). One test, the *Multifactor Emotional Intelligence Scale*, measures 12 emotional abilities that are, in turn, grouped into four "branches of abilities"—perceiving, facilitating, understanding, and managing emotion (Mayer, Salovey, & Caruso; 2012; Maul, 2011; Zhoc, Li, & Webster, 2017).

Although some theorists believe that certain individuals are inherently more skilled than others in the emotional sphere, other theorists argue that emotional intelligence can be learned and they call for schools and businesses to offer systematic instruction in the understanding and management of emotions (Argyriou, Bakoyannis, & Tantaros, 2016). James Parker and his colleagues at Trent University have shown that several facets of emotional intelligence are very strong predictors of success within the university context (Hogan et al., 2010; Keefer, Parker, & Wood, 2012; Parker, Saklofske, & Keefer, 2016). Parker has also shown that helping students to improve their skills in those areas of emotional intelligence positively impacts their academic performance and makes it more likely they will stay in university as they move from their first to second year of studies (Parker et al., 2016).

Social Intelligence

Most of us know someone who displays remarkable social savvy, a person who can walk right into a party or a meeting and just take over the room. Such people seem to know

intuitively what is important to others, how to charm their way out of difficult situations, and how to gain the affection of everyone with whom they interact (see photo). Would you say these individuals are highly intelligent? Some theorists would say yes (Boyatzis, Gaskin, & Wei, 2015; Murphy & Hall, 2011). Specifically, they would say that these individuals are high in *social intelligence*.

The notion of social intelligence is older than that of emotional intelligence. In fact, early in the twentieth century, the learning pioneer Edward Thorndike (whom you may remember from Chapter 7) suggested that intelligence consists of three facets: the ability to understand and manage ideas (abstract intelligence), concrete objects (mechanical intelligence), and people (social intelligence) (Thorndike, 1920). By social intelligence, Thorndike meant "the ability to understand and manage men and women, boys and girls—to act wisely in human relationships." Other theorists have described social intelligence more simply as the ability to get along with others. Either way, it is clearly an important asset, not only in interpersonal relationships, but also at school and work, in leadership roles, and in our online environments (Furnham, Crump, & Ritchie, 2013; Farnia & Nafukho, 2016; Meyer & Jones, 2012; Moe & Schweidel, 2014).

VCG/Visual China Group/Getty Images

Social intelligence **Famous Candian actor Ryan Reynolds needs high social and emotional intelligence to be able to work with others and empathize with his characters and audiences to be successful in the roles that he plays.**

Wisdom

In myth, art, and popular culture, we often encounter characters, often older people, who do not possess much formal education but who seem to have an insightful appreciation of life and the world. They are generally portrayed as experienced in the ways of the world; little about life appears to surprise them. These people are considered to possess *wisdom* (see photo), the ability to make sound judgments about important, difficult, or uncertain situations and to choose the best course of action (Karelitz, Jarvin, & Sternberg, 2010; Ardelt & Oh, 2016; Weststrate, Ferrari, & Ardelt, 2016). Are intelligence and wisdom the same thing?

Robert Sternberg (2010, 2013, 2018b) believes that wisdom is a special version of intelligence, and has developed the *balance theory of wisdom* to account for this special capacity. Recall that in Sternberg's triarchic theory, intelligence consists of three aspects—analytic, creative, and practical—with practical intelligence involving the ability to effectively apply one's experiences and learning to everyday decisions. According to Sternberg, wisdom is primarily (though not entirely) the product of practical intelligence. He says that wisdom is the application of tacit knowledge—"know-how"—to solve problems in such a way that a common good is achieved and a balance maintained among the interests of the individual, the community, and society. Sternberg distinguishes wisdom from other expressions of practical intelligence by noting that wisdom involves a particular concern for the community at large and a careful balancing of interests.

Marilyn Angel Wynn/Getty Images

Wisdom **Wisdom, such as that acknowledged among Indigenous communities in people respected as Elders, is viewed as being acquired with age and experience and not directly related to general intelligence.**

More than any other dimension of intelligence, wisdom may be associated with age. When people are asked to name someone in their lives whom they consider to be wise, they are more likely to point to a grandparent, an uncle or aunt, or a parent, rather than to a teenager or young adult. Why? Because it typically takes years and repeated experiences to appreciate the needs of the community, the advantages of compromise solutions, the

drawbacks of self-serving decisions, and the delicate art of balancing multiple perspectives (Ardelt, 2011; Weststrate et al., 2016). That is, it takes time and experience to acquire a high degree of wisdom. However, not all older people are wise, and some younger people are wise; although there is a strong correlation between age and wisdom, age does not *cause* wisdom (Thomas & Kunzmann, 2013).

Creativity

Creativity is the ability to produce ideas that are both original and valuable (Kaufman & Sternberg, 2010). Like wisdom, creativity reflects collective, as well as personal, values. Societies benefit from the creativity of their members; indeed, creativity plays a key role in technological, scientific, and artistic advances. Thus, it is not surprising that different cultures define and appreciate creativity in different ways (Lubart, 2010; Runco, 2014, 2010). Creativity often requires verbal and mathematical skills in Western culture, for example, while it depends more on the ability to appreciate and interact with nature in some other cultures (Runco, 2014). (See photos.)

creativity the ability to produce ideas that are both original and valuable.

Psychologists who study creativity and intelligence typically believe that a high intellectual aptitude is necessary but not sufficient for creativity (Kim et al., 2010; Kaufman, 2015). People who score high on intelligence tests tend to score high on tests of creativity, but beyond a certain point (that is, beyond an intelligence test score of about 120), the correlation between intelligence and creativity diminishes. Research has shown, for example, that on average, exceptionally creative architects, musicians, scientists, and engineers do not score higher on intelligence tests than do their less creative colleagues, though both groups are highly intelligent (Jauk, Benedek, Dunst, & Neubauer, 2013). Thus, it appears that there is more to creativity than what intelligence tests measure.

Bruno Morandi/Getty Images, Inc.

FatCamera/Getty Images

Creativity around the world **Different cultures encourage different kinds of creativity. A woman who can decorate a customer's hand with a beautiful henna design in India (*left*) is considered highly creative and intelligent in her country, while a Canadian programmer who addresses his firm's production needs by developing a complex computer model (*right*) is considered highly creative by his colleagues.**

Theorists and researchers have pointed to various personal qualities as being key to creativity (Cramond et al., 2010; Sternberg, 2018b, 2003). At the top of the list is *intrinsic motivation*, an internal drive to create. Also cited frequently are *imagination*—an ability and willingness to reexamine problems in new ways—and a *game personality*, one that tolerates ambiguity, risk, and initial failure. Other useful qualities important to creative thought include complex thinking, broad attention, expertise in relevant fields, broad interests, high energy, independence, and self-confidence. Finally, divergent thinking is often seen as a key part of creativity. Measures of divergent thinking include seeing how many different ways people can think about simple objects or events. For example, how many different uses can you think of for a brick? The more uses you can come up with in two minutes, the higher your scores are likely to be on other measures of creativity (Runco & Acar, 2012).

Ron Bull/Getty Images

Creative environment? Dancers at the National Ballet of Canada are immersed in a creative environment.

Investigators have also found that creative thinking is, in fact, nurtured, inspired, and refined by creative environments (Davies et al., 2013; Sternberg, 2010). Creative environments share several qualities: they encourage people to be innovative; are

relatively free of criticism; and provide freedom, creative role models, sufficient resources, and time to think and explore. Artist communities and schools for the performing arts aspire to be environments of this kind. Some such communities and schools succeed in this regard, while others may become more demanding and competitive than nurturing. While we often think of creative environments in relation to artistic communities, a creative environment is also important for the stimulation of creativity in the sciences (de Manzano & Ullén, 2018). (See photo.) In addition, a creative environment need not be large or formal; it can exist in a supportive home, a positive work setting, or a comfortable class. (See Indigenous Experiences 10.1.)

Personality Characteristics

Even the earliest researchers of intelligence noted a relationship between intelligence and personality, our unique patterns of experiencing and acting in the world. Although intelligence tests often seek to separate intellectual functioning from personal style, many theorists argue that the division is artificial—that personality characteristics are inherent to intellectual functioning (Bergold & Steinmayr, 2018; Boyle et al., 2016; Mayer, Panter, & Caruso, 2012; Reichard et al., 2011). Indeed, David Wechsler (1961), a pioneer in intelligence testing, considered intelligence to be a manifestation of personality. He thought that emotional, motivational, and other personal characteristics (such as interest and volition) must be key components of any meaningful notion of intelligence.

Following Wechsler's lead, a number of today's theorists think of intelligence as the cognitive part of personality (Murphy & Hall, 2011; Rammstedt, Danner, & Martin, 2016). Others propose a complex reciprocal relationship between intelligence and personality, with intellectual, emotional, and motivational variables repeatedly affecting each other in day-to-day behaviour (Hennessey, 2010; Mayer, Caruso, & Salovey, 2016). Consistent with such notions, studies have found that negative emotional and motivational states can impair intellectual performance to some degree, especially when the intellectual tasks demand attention or quick recall. Conversely, certain personality factors, such as self-efficacy (the belief that one can master a demanding task) and a high need to achieve, often enhance performance on intellectual tasks (Freund & Holling, 2011; Honicke & Broadbent, 2016; Zhang & Ziegler, 2016).

10.1 Indigenous Experiences

Creativity: Indigenous Graffiti and Street Art

Over time, Indigenous art has gained institutional recognition in Canada. Indigenous artists, curators, and administrators have become increasingly recognized as part of the mainstream Western formalized art establishment. However, alternative decolonial stories are also being created by grassroots artists through graffiti and murals and other forms of street art. Street art rejects conventional colonial restrictions and is instead direct, informal, uncensored, and capable of reaching a broad public audience. An artist who uses the moniker Red Bandit said of his own self-expression: "My father was a Sixties Scoop kid from the West Coast. Like my father, I grew up in the city without a Native parent to look up to. Without any kind of thread to

lead me home. I'm a mixed baby. I belong nowhere. I am nobody, really. I am unwanted everywhere I go. I am a Native child in a world that seeks to erase me, but I will be heard" (Desmarais & Larivee, 2017).

In August 2014, the first Decolonize Street Art Event: Anti-Colonial Street Artists Convergence was held in Montreal to "advocate the decolonization of Turtle Island," the Indigenous name for North America (Smith, 2014; Solidarity Across Borders, 2014). The event brought together Indigenous and feminist graffiti artists and street artists, activists, and community members to take part in creating original, critical graffiti and street art to build and critique a community built on shared anti-colonial values and to create conversations focused on decolonization. Participating Canadian artists included Camille (Montreal), Nigit'stil Norbert (Yellowknife), Erin-Marie Konsmo (Edmonton), Mitra Fakhrashrafi (Toronto), and many others (Solidarity Across Borders, 2014). Although street art is also at times anonymous or signed by a collective, at this event many of the participating artists were already involved in protesting issues related to Indigenous injustice, including environmental struggles or finding justice for missing and murdered Indigenous women. The goal of the event was to develop a sense of solidarity among street artists, to promote resistance to colonialism, and to create dialogue within the broader community, using an unfettered creative forum.

Source: Image courtesy of Jessica Sabogal, In, S.H. Awad, B.Wagoner (eds.), Introducing the Street Art of Resistance. Palgrave Studies in Creativity and Culture. Pg. 253 Also at: http://www.articulationmagazine.com/decolonizing-streetart

The impact of street art **The caption accompanying this mural created for the Decolonize Street Art event in Montreal says "Our existence will no longer be silent." The mural depicts artist Jessica Sabogal's work *We the Indivisible*.**

Critical Thinking Questions

How can the use of street art bring attention to a social injustice?

How can street art be used to develop solidarity around a justice cause between individuals?

What further roles can you see creativity and art playing in supporting the goals of the Truth and Reconciliation Commission of Canada?

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

14. What is emotional intelligence and how is it measured?

15. How does Robert Sternberg describe wisdom in relation to his triarchic theory of intelligence?

16. What are some factors that affect creativity?

What Do You Think? • Suppose you were given the job of making up a test to assess social intelligence. What kinds of questions would you include on the test? How would the development of your test be influenced if it focused on social intelligence and the use of social media?

How Is Intelligence Influenced by Biological and Environmental Factors?

LEARNING OBJECTIVE 4

Review the contributions of biological and environmental factors to intelligence, and explain how emphasizing different factors can affect social policy.

Do we inherit our intelligence from our parents? What role does our biology (genes and nervous system) play in the development of our intelligence? What influence can our experiences, such as our upbringing, schooling, and familiarity with test taking, have on the development of, and our intelligence as adults? If genes were clearly identified as the main determinant of intelligence, what might some of the social consequences be? For some, such a finding might be taken to justify claims that particular individuals or groups of people are inherently superior to others. Such people might even seek to create a social structure that assigns people to classes according to their genetic profile and restricts certain classes to particular social roles.

On the other hand, what if the environment were found to be more decisive in determining intelligence? Children from disadvantaged environments would be expected to lead disadvantaged lives and display, on average, lower intelligence; but then again, their environments and their intellectual level could potentially be improved (see photos). But would people who possessed environmental advantages be willing to share them with those who were deprived?

amriphoto/Getty Images

rollover/Getty Images

Environmental impact **Research indicates that a stimulating environment can help facilitate the intellectual development of children, whereas a deprived environment has a negative impact on social and neurological development.**

The Bell Curve Controversy

In 1994, two researchers published a book that ignited a firestorm of controversy regarding the issue of intelligence, that continues to this day (Ma & Schapira, 2017; Staub, 2018). In *The Bell Curve*, Richard Herrnstein and Charles Murray surveyed research on the origins and nature of intelligence, and also reported their own analyses. Based on this large amount of data, the authors drew several controversial conclusions. Numerous psychologists, educators, and researchers argue that many of the authors' conclusions do not follow from the data. The conclusions offered by Herrnstein and Murray were:

Conventional IQ tests accurately measure intelligence.

IQ is an important predictor of many measures of success in life, including success at school, work, parenting, and income. Higher IQ also predicts the avoidance of welfare dependence and criminality.

Given such correlations (which do not equal causation), people who are high in intelligence form a cognitive elite—they reach the upper levels of society—whereas those with lower IQs fall toward the bottom.

Given their predictive powers, intelligence tests can and should be used as a *gating* mechanism, to allow those with high IQs access to opportunities.

IQ is largely heritable, passed on through the genes from one generation to the next.

There are clear racial and ethnic differences in intelligence.

It is likely, although not certain, that at least some of this difference between groups is due to genetic factors.

Herrnstein and Murray went on to argue for greater acceptance of these ideas and benign recognition of the limitations of individuals with lower IQs, making greater efforts to help them in areas of life where lower intelligence holds them back. As you might imagine, the debate over the book's conclusions and implications remains heated 25-plus years later. As noted above, most psychologists and researchers argue that many of the authors' conclusions do not follow from the data, and may instead reflect the authors' ideology or

personal beliefs (Devlin, Fienberg, Resnick, & Roeder, 2013; Flynn, 2008, 2000; Sternberg & Grigorenko, 2013). Furthermore, the social policies they recommend on the basis of their conclusions (e.g., do away with Head Start and other programs aimed at providing developmental enrichment to children from low-income families, require couples to be married if their children are to receive any child support following a breakup, and install mandatory sentences for crimes, like simple possession of drugs, all of which would disproportionately apply to non-white racial groups) are unfair and racist.

Genetic Influences on Intelligence

A variety of studies however, do suggest that genetic factors play a role in intelligence. In particular, studies of twins and other relatives and research in molecular biology point to genes and their role in brain development as important contributors to intelligence in adulthood.

Rick Gershon/Getty Images

The heritability of intelligence **Twin studies suggest that genetics play a major role in intelligence. There is a higher correlation in IQ scores for identical twins in contrast to all other family comparisons.**

Family Studies

Twins have received particular attention from intelligence researchers. If genetic factors are at work in intelligence, identical twins (who share all their genes) should have more similar intelligence test scores than fraternal twins (who share only about half of their genes). This expectation has been supported consistently by research (Bates, Hansell, Martin, & Wright, 2016; Kaplan, 2012; Polderman et al., 2015). Studies have found, on average, a correlation of +.86 between the intelligence test scores of identical twins, compared with a correlation of +.60 between the scores of fraternal twins (see photo).

Do such findings mean that intelligence is related *primarily* to genes? Not necessarily. It turns out that parents treat identical twins more similarly than fraternal twins. In fact, family studies find that identical twins are treated the most alike of all siblings, followed by

same-gender fraternal twins and then different-gender twins (Felson, 2014). Perhaps, then, the more closely related intelligence scores found among identical twins are, at least in part, a reflection of more similar interactions with parents.

To help sort out the relative influence of heredity and environment, we might want to look at IQ scores for identical twins who have been raised apart from one another. If genetic factors are important determinants of intelligence, then the scores should remain closely related. In a recent review of the literature, Kaplan (2012) concludes that there are studies showing that different environments do not have much of an effect on intelligence scores. This suggests that IQ is largely heritable, but that doesn't negate environmental effects, to which we will return in the next section (Segal & Cortez, 2014).

Another approach to the heredity and intelligence question is to examine the relationships between the IQ scores of adopted children and those of their biological and adoptive parents. We do know that children of smart parents score higher on tests of cognitive achievement or intelligence, even when controlling for education and family background (Anger & Heineck, 2010). If heredity is more influential than environment, the IQ scores of adopted children should be more similar to those of their biological parents than to those of their adoptive parents. If environment matters more, we should find the children's IQ scores closer to their adoptive parents' scores than to the scores of their biological parents. To address the question of how biology or environment influence IQ scores a group of scientists in Sweden carried out a study of siblings where one was raised with their biological parents and the other was raised by adoptive parents. What they found was that there were marginal differences in the IQ scores of these siblings suggesting that biology and environment play similar or relatively equal roles in the development of intelligence. Interestingly, the sibling raised by the adoptive parents scored slightly higher than the sibling raised with their biological parents. This effect, however, was influenced by the education of their respective parents. The higher the educational level of the parents, the higher the IQ scores of the offspring (Kendler et al. 2015). This pattern of findings indicates once again that the nature–nurture question is not a simple one to answer.

All of these family studies suggest that genes play a role in intelligence, but exactly how much of a role? Scientists have sought to answer this question by examining the specific data from many studies and arriving at an overall estimate of the heritability of intelligence. **Heritability** is the overall extent to which differences among people are attributable to genes. Evaluating the data from studies of twins and other relatives, researchers have determined that the heritability of intelligence is approximately 50 percent (Polderman et al., 2015; Feldman & Ramachandran, 2018). It is important to note that the concept of heritability is used to explain the differences between groups of people, not to provide information about a single individual. Thus, the finding that the heritability of intelligence is around 50 percent does not mean that 50 percent of a particular individual's intelligence is inherited. Rather, it suggests that 50 percent of all differences or variabilities observed in a population's intelligence test scores are due to genetic factors.

> **heritability** the amount of a given trait that can be attributed to inherited genetic factors.

The statistical measure used to indicate the contribution of heredity to intelligence (or to

any other characteristic) is the **heritability coefficient**, a number ranging from 0.00 to +1.00. A coefficient of 0.00 means that heredity has no impact on variations observed among people, whereas a coefficient of +1.00 means that heredity is the sole influence on the characteristic under investigation. For example, the heritability coefficient for Huntington's Disease, a debilitating and lethal disorder of uncoordinated movements and loss of brain cells in adulthood, is +1.00. Genetic factors are 100 percent responsible for this disorder and many children of parents with this disorder go through genetic testing prior to having children of their own to make sure they are not passing the huntingtin gene on to their children. In contrast, as we have just observed, the heritability coefficient for intelligence is +0.50—a figure that holds in studies conducted around the world, from Canada and the United States to Russia, Japan, and India (Polderman et al., 2015; Feldman & Ramachandran, 2018).

heritability coefficient a correlation coefficient used to indicate the contribution of heredity to some characteristic, such as intelligence.

Environmental Influences on Intelligence

If the heritability of intelligence is around 50 percent, then aspects of the environment a person grows up in must influence the development of their intelligence. It is important to remember that genes do not act in isolation. In fact, genes do not "decide" to act at all. Rather, we all have a genetic program that is activated by the environment at the cellular, systems, and whole organism levels. The term *environment* can have a narrow or broad meaning. It can refer to our home setting, neighbourhood, extended family, school, or socio-economic group. It even can refer to biological events and experiences that a fetus confronts in its mother's uterus. Or, it can refer to the sum of all such contexts. Four environmental influences have received particular attention in the study of intelligence: family and home, culture, occupation, and schooling.

Louise Murray/robertharding/Alamy Stock Photo

Societal needs and intelligence **An individual's particular expression of intelligence is often tied to the survival needs of his society.**

Family and Home Environment

The first overtly social environment to which we are exposed in life and the one that dominates our childhood is the family and home. Our parents' childrearing methods and other characteristics, our interactions with siblings, the objects in our houses, family trips —these are all parts of our family and home environment. Do such environmental factors affect children's intelligence? (See Practically Speaking 10.1.)

Cultural Influences

Most definitions of intelligence include how well people adapt to their environments (see Psychology Around Us 10.2). This criterion raises an important question: does the definition of intelligence change across different cultural environments? Many researchers say yes, the definition of intelligence varies from culture to culture (see photo) (Matsumoto & Juang, 2016).

Note that this is different from asking whether people from different parts of the world (or from different racial or ethnic groups) have different levels of intelligence. That question relates more to the idea of comparing general intelligence. Instead, here we are more concerned with comparing specific skill sets that constitute intelligence in different cultures. Researchers have found that the values of a society or cultural group often have powerful effects on the intellectual skills of its members. Canadian Inuit, for example, are particularly skilled at understanding the environment of the Canadian North. Their understanding of the ecosystem is becoming more valued as our society becomes more concerned with the effects of climate change on sea ice and the animals, such as polar bears, that live in these areas (Aporta, 2011; Henri, Gilchrist, & Peacock, 2010; Stern, 1999). Specific understanding of the ecology a person lives in would improve individuals' ability to survive and thrive within their cultures, and thus would be valued components of intelligence within each culture. Such principles can apply within subcultures as well; as the example at the beginning of the chapter demonstrates, a knowledge of theoretical physics and obscure comic hero trivia, by Sheldon Cooper from *The Big Bang Theory*, are prized abilities in some Western subcultures.

10.1 Practically Speaking

Can Parents Improve Their Children's Intelligence?

Early theories held that an individual's intellectual capacity was fixed at birth. The many examples presented throughout this chapter of how the environment can affect intelligence certainly challenge this initial assumption. In particular, we now know that interventions of various kinds can improve intellectual functioning.

In the 1970s and 80s, two scientists, Robert Bradley and Bettye Caldwell, began to study the impact of the home environment on the development of intelligence. They and others have identified several parenting approaches that may help raise the IQ scores of preschoolers (Bradley, Caldwell, & Rock, 1988; Bradley & Caldwell, 1984). These researchers claim that such approaches are better predictors of IQ scores than factors such as socio-economic class or family structure. Current research seems to support their assertions (Bradley, 2015; Mahli, Sidhu, & Bharti, 2014).

The parent to-do list includes:

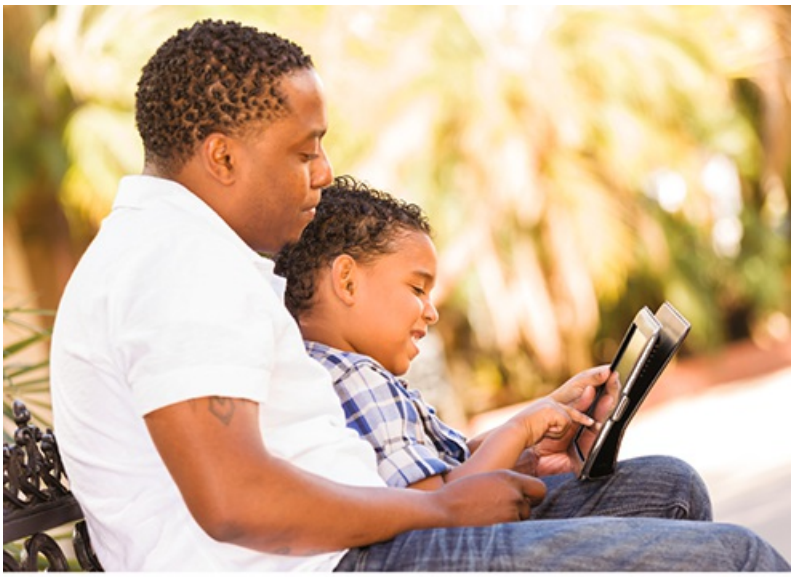
Be emotionally and verbally responsive and involved with your child: comment on and talk about what she is looking at and noticing, draw your child's attention to things around her.

Avoid too much restriction and punishment: within reason, allow your child to explore his environment and do things for himself.

Organize the physical environment and the child's activity schedule: have an area of your home that is set up for the child and is child friendly.

Provide appropriate play materials: they do not have to be expensive child play toys, just things to challenge your child and encourage activity and exploration.

Provide a variety of forms of daily stimulation: build in some play time with your child and, when she is older, with other children. Where possible, include your child in outings to local stores or even just for walks around your neighbourhood.



Feverpitched/Getty Images

Engagement is critical **To help your children excel in life encourage activity, exploration and be emotionally engaged with your child.**

10.2 Psychology Around Us

IQ Testing and Cultural Norms

The debate over how to measure an individual's intelligence has raged for well over a hundred years (Wasserman, 2018). Indeed, in the nineteenth century it used to be thought that the shape of one's head could determine one's mental abilities using the process known as phrenology. By the early twentieth century, testing moved toward a model put forth by Alfred Binet, who created the first model for intelligence testing, and as you see in this chapter, he is considered the father of modern intelligence

testing as we know it today.

But there have always been questions about the accuracy of intelligence testing. For example, is it possible to have one test that correctly identifies all aspects of intelligence accurately? Do the current intelligence tests correctly predict emotional intelligence or creativity? Currently, the one test most associated with intelligence is the IQ, or intelligence quotient test. There are many varieties of this test, and not surprisingly there are issues around IQ testing even among standardized tests such as the Wechsler Adult Intelligence Scale (WAIS-IV).

Allyson Harrison from Queen's University in Ontario has been questioning how IQ tests are used and how the scores are compared across different groups and countries (Harrison et al., 2014). Canada is a multicultural country, two or more languages are used widely, and there are differences in educational curricula between provinces and territories that may make it impossible for standardized IQ test norms to be generated within Canada that are appropriate for comparison of an individual's IQ test score to other individuals across our country. For this reason, the International Test Commission, which is a group composed of psychologists and test developers from around the world, declared that culturally appropriate norms must be applied to WAIS-IV testing in order for it be accurate. What that looks like for Canada, and whether standardized IQ test norms that are reliable and valid can be developed for Canadians, remains to be determined (Shuttleworth-Edwards, 2017).

David Crockett/Getty Images

The puzzle of measuring intelligence **How to measure human intelligence is an ongoing debate among scientists.**

Most of the assumptions about intelligence that we have looked at so far are Western-oriented. Western views of intelligence tend to be influenced by the Western value of individualism, while some other cultures place more emphasis on the community as a whole. Moreover, Westerners tend to equate high intelligence with rapid mental processing, whereas other cultures may value depth of thinking, even if it occurs at a slower rate (Sternberg 2007, 2015, 2018a; Sternberg et al., 1981). One study found that Taiwanese-Chinese theorists typically point to five factors at the root of intelligence: (1) a general cognitive factor; (2) interpersonal intelligence (knowing about others); (3) intrapersonal intelligence (knowing about oneself); (4) intellectual self-assertion (advocating for your own intellectual achievements); and (5) intellectual self-effacement (being humble about your intellectual achievements) (Yang & Sternberg, 1997; Sternberg, 2014, 2018a). While the first three qualities are similar to factors in some Western definitions of intelligence, the final two are not. Also, Westerners often believe that intelligence further involves verbal skill and the ability to solve practical problems, features

absent from the Taiwanese-Chinese list.

Occupational Influences

Researchers consistently have found a relationship between intelligence and job complexity (see photo). People of higher intelligence tend to work in more complex jobs (Hunt, 2010; Ganzach, 2011; Ganzach & Pazy, 2015). An obvious explanation for this relationship is that individuals of higher intelligence can handle complex jobs more readily than less intelligent people, and so are more likely to obtain and succeed in such positions.

Studies also suggest, however, that complex work may itself improve intelligence. For example, a job that requires workers to organize, interpret, and write detailed computer code may help produce more intellectual depth than one requiring individuals to only play the video games that are the result of that code. Why would more complex jobs enhance intellectual skills? Perhaps because holders of such jobs are forced to acquire a greater amount of complex information and knowledge (Kuncel, Ones, & Sackett, 2010; Kuncel, Rose, Ejiogu, & Yang, 2014)—the very kinds of information and knowledge that are measured on intelligence tests. As the world of work changes with our advances in technology, it will be interesting to see how the relationships between one's employment and cognitive intelligence evolves (see photo). The relationship between the type of work we do and others areas of intelligence—emotional, social, and creative—are also of interest and are beginning to be studied (Doe, Ndinguri, & Phipps, 2015; Joseph, Jin, Newman, & O'Boyle, 2015; Lievens & Sackett, 2012).

Gorodenkoff/Shutterstock.com

Which causes which? People in complex jobs, such as this engineer are often highly intelligent. Does their high intelligence qualify them for more complex work, or does the complex work increase their intelligence? Research supports both explanations.

School Influences

Researchers have determined that schooling is both a cause and consequence of intelligence (Protzko, 2017; Ritchie et al., 2013; Shayer & Adhami, 2010). Children with higher intelligence test scores are more likely to be promoted from grade to grade, less likely to drop out of school, and more likely to attend college or university. In turn,

schooling helps change mental abilities, including those measured on intelligence tests.

Researchers Stephen Ceci, to whom you were introduced in the section on theories of intelligence at the beginning of this chapter, Wendy Williams (2010, 2007, 1997), and others have demonstrated some interesting ties between intelligence scores and the amount of time spent in school. Students' IQ scores tend to rise during the school year and drop when schooling is discontinued or during summer vacation. Students who complete high school perform higher on intelligence tests than those who leave school early. And young children whose birthdays just make the cut-off for beginning school early earn higher intelligence scores than those of almost identical age who miss the cut-off and remain at home for an extra year.

Gorynvd/Shutterstock.com

Times are changing Some psychologists believe that the increased use of technology and flexible learning spaces improve the quality of a school environment.

In a recent meta-analysis of education and intelligence, Ritchie & Tucker-Drob (2018) found that IQ scores went up between one and five points for each year of education. They argue that education is the most consistent means for raising IQ scores across the population. This influence of education on IQ and cognition is most effective during childhood and adolescence (Kremen et al., 2019). Why might schooling help improve intelligence scores? This finding may be due in part to the fact that schools provide the opportunity to acquire information (Who wrote *Animal Farm*? What is the square root of 16, and how do you calculate it?). Schools provide spaces for all of us to develop important skills such as problem solving, thinking abstractly, visual processing, verbal comprehension and working memory—all skills measured on intelligence tests. Researchers have also shown that the *quality* of the school environment affects intellectual performance (see photo). In financially poor schools, children tend to learn less, and in turn, tend to score significantly lower on IQ tests (Johnson, 2010; Reardon, 2013).

Michael Austen/Alamy Stock Photo

Schooling and intellectual performance **Research indicates that an enriching school environment contributes to better intellectual performance.**

Group Differences in IQ Scores

Recall that at the beginning of this section you read about *The Bell Curve*, in which the authors argued that group differences in IQ may be due largely to genetic factors. This was followed by evidence showing that intelligence is, indeed, heritable, but that environment plays a significant role as well. Work on the relative contributions of biology and environment to IQ raises the question of whether there are group differences in IQ and what factors might account for these differences and allow us to increase our intelligence (see Your Brain and Behaviour 10.1).

When thinking about possible group differences in intelligence, it is important to understand what we mean when referring to groups. The following analogy by geneticist Richard Lewontin (2001, 1982, 1976; Feldman & Lewontin, 2008) is helpful. Suppose you start with 100 plant seeds from the same source and divide them into two groups. You plant one group of seeds in a flowerpot filled with poor soil and the other group in a flowerpot filled with fertile soil. What differences would you expect between the groups of seeds as they grow into plants? As shown in **Figure 10.8**, you should see two kinds of variation: variation between the two groups and variation within each group. When evaluating these variations, we need to keep in mind two principles that also apply to

evaluating group differences in intelligence scores:

Environment contributes to variation between the groups. The plants growing in poor soil vary from the ones growing in good soil, even though all of the plants came from the same mixture of seed. For example, the plants raised in poor soil are, on average, shorter than those raised in fertile soil. This difference is probably attributable to the environment. In short, optimal environments tend to produce optimal plants, and deficient environments tend to produce less successful plants. Similarly, on average, groups that display lower average IQ scores have been raised in worse environments than the groups with higher scores.

An average variation between groups cannot be applied to individuals within each group. In our plant example, even though on average the plants growing in poor soil are shorter than those growing in good soil, some of the poor-soil plants will be taller than others. Some will probably even be taller than the average plant in the good soil. These differences probably are attributable to normal genetic variation, since all the plants in a given pot share the same environment.

10.1 Your Brain and Behaviour

Nootropics: Enhancers of Cognition and Intelligence?

All of us would like to increase our intelligence, but is it possible? Is there a magic pill? Many of us use cognitive enhancing compounds everyday. The glucose we get from food is critical for our brain's ability to function. Caffeine, which so many of us rely on to start our day, has been shown to increase our alertness and ability to focus. It may feel like caffeine is enhancing our cognitive abilities, but there is no evidence that it makes us smarter (Nehlig, 2010). To actually try to increase intelligence with pharmaceuticals, some people have turned to a relatively new category of drugs, nootropics, to enhance their performance.

Nootropics (see photos) are used to enhance mental functioning in individuals suffering from the cognitive decline associated with diseases such as Alzheimer's or dementia (Chiroma et al., 2019; Garcia et al., 2017). Nootropics are often referred to as "smart drugs" and can be classified as either naturally occurring compounds such as *Ginkgo biloba, Hericium herinaceus*, or *Bacopa monnieri*, among many others, or synthetic compounds. The newer synthetic smart drugs, modafinil and piracetam, along with older stimulant drugs such as amphetamine and methylphenidate, may lead to improved mental functioning in areas like motivation, concentration, learning, and memory—all of which arguably underlie measures of intelligence (Urban & Gao, 2017).

Several online blogs, discussion boards, and forums exist where people are weighing the pros and cons of all of these drugs as cognitive enhancers, with many people praising their effectiveness. However, if you think back to Chapter 2, recall that we all can have a bias toward believing what we want to believe whether or not that belief has been scientifically validated. It can take many months or years for a researcher to design and carry out a study to evaluate the effects of one of these drugs on cognitive performance and intelligence. Yet online consumers and commentators tend to expect

quick answers. Keeping all of what you just read in mind, what do we know about nootropics and cognitive enhancement in individuals who are not suffering from dementia or Alzheimer's disease?

There are no clear safety and regulatory guidelines for the use of cognitive enhancers in healthy individuals. This raises significant safety concerns; we don't know how safe they are, or what the long-term effects of repeated use on brain function in healthy individuals will be (d'Angelo, Savulich, & Sahakian, 2017; Urban & Gao, 2017).

Certain drugs, like amphetamine and methylphenidate, which is used to treat attention deficit hyperactivity disorder, are two of the oldest drugs used as cognitive enhancers. These drugs may improve memory consolidation and recall but there can be a variety of negative effects on the developing brain, especially in adolescents. These effects can include the permanent loss of synaptic connections between neurons in the dopamine system (Urban & Gao, 2017). These changes may have lifelong effects on our ability to feel reward and pleasure, especially as the brain ages.

A recent study in chess players looked at whether methylphenidate or modafinil can influence performance. The researchers found that there was a slight improvement in performance but only when there was no time pressure. When these chess players had to perform within a time constraint, their performance was no longer enhanced (Franke et al., 2017). Use of these drugs in healthy individuals is often during periods of stress and time pressure. So while these drugs may keep a person awake a bit longer, their effectiveness on actual task performance may be minimal.

In a recent meta-analysis, a small effect was found on cognitive functioning, but only in individuals who weren't sleep deprived, so the use of these drugs to combat sleep may counter any effects they have on cognition (Kredlow, Keshishian, Oppenheimer, & Otto, 2019).

There is a dearth of scientific evidence showing that the use of nootropic drugs leads to meaningful improvement in cognition or intelligence in individuals who have not been diagnosed with cognitive decline due to diseases such as dementia or Alzheimer's Disease. We know very little about how the repeated use of the new synthetic cognitive enhancers may alter brain development or affect the long-term function of the brain in healthy individuals. While many of these drugs are hyped online as helping students achieve better grades or helping employees work "smarter," scientific research doesn't provide much support for these claims.

Questions

What diseases do the newer classes of nootropics treat?

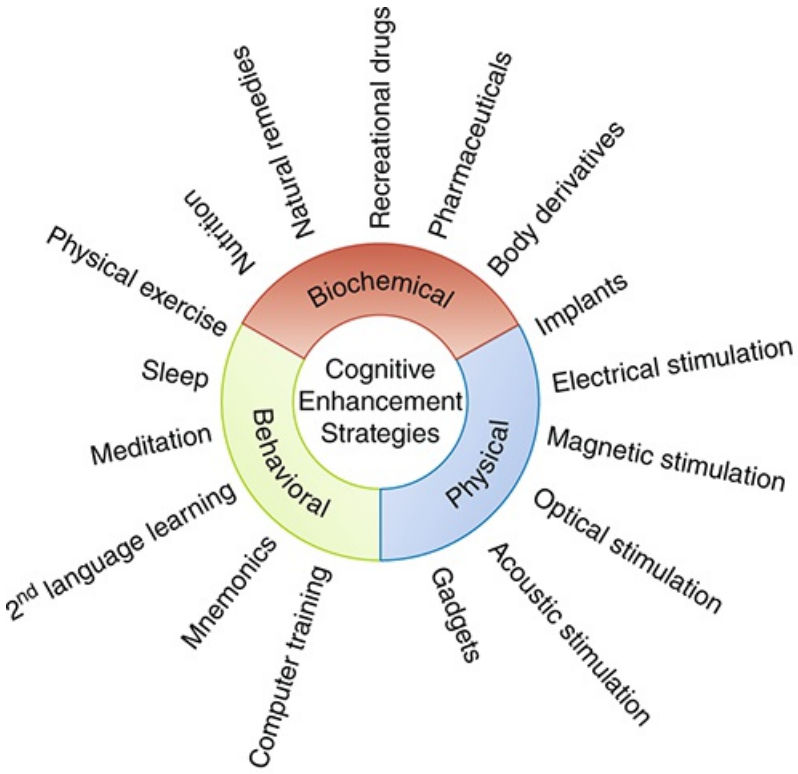
What key system in the brain does amphetamine and methylphenidate affect, and how?

What evidence is there that nootropics can enhance behavioural

performance in individuals who are not suffering from cognitive decline?

inkoly/Getty Images

Behavioural areas for cognitive enhancement and treatment options **There are three main categories of cognitive enhancers that may influence how well we perform on tests of intelligence: Biochemical (including nootropics), physical, and behavioural. To enhance cognitive abilities, any one of these modalities, or combinations of them, may be useful but it is important to look for scientific evidence for their effectiveness in improving mental abilities and intelligence.**



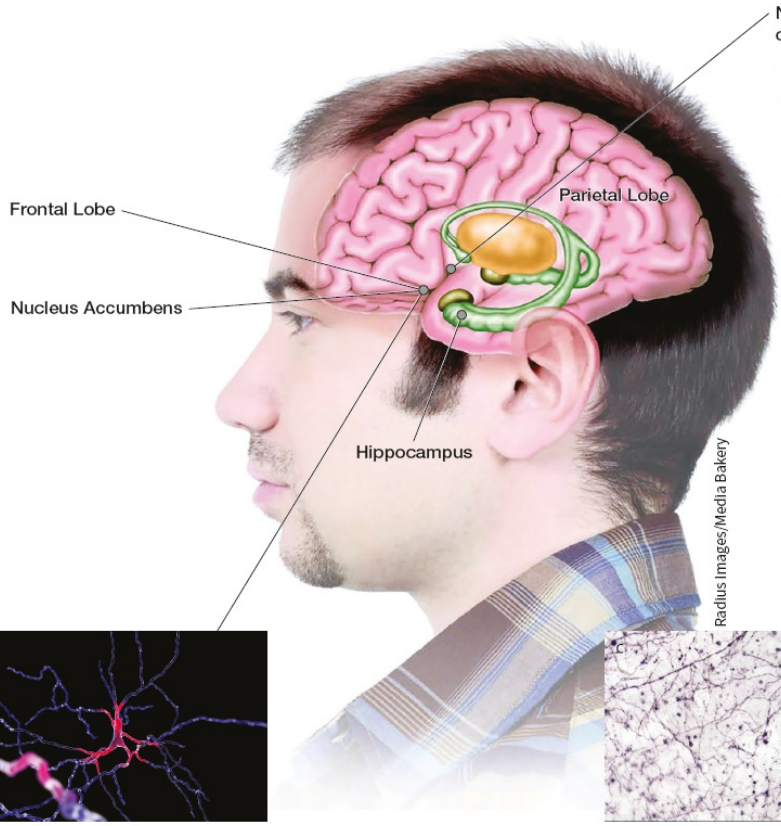
Dresler, M., Sandberg, A., Bublitz, C., Ohla, K., Trenado, C., Mroczko-Wasowicz, A., ... & Repantis, D. (2018). Hacking the brain: dimensions of cognitive enhancement. ACS chemical neuroscience, 10(3), 1137–1148.

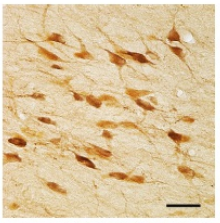
Source: Jon Schulte/123RF

Older cognitive enhancers **Several older drugs that are used as cognitive enhancers, amphetamine and methylphenidate, affect the function of dopamine neurons in the ventral tegmental area and nucleus accumbens—the neurocircuitry involved in reward. There is no evidence of any positive long-term effects of these drugs on intelligence or cognitive function.**

World's Toughest Race: Eco-Challenge Fiji / MGM Television & Amazon Studios

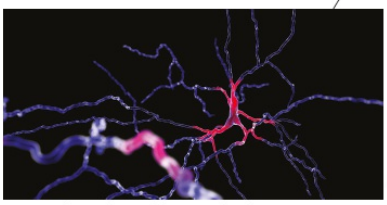
Nootropics and cognitive decline **Mark Macy (pictured here) recently participated in the World's Toughest Race: Eco Challenge Fiji (2019) with his son Travis as part of team ENDURE. At the time of the race, Mark had been diagnosed with early-onset Alzheimer's. Nootropic drugs that block acetylcholine cell loss in the brain can attenuate some of the cognitive decline seen in these individuals.**





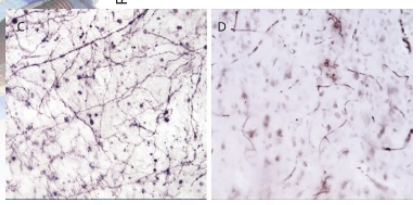
Source:Tulemo, https://upload.wikimedia.org/wikipedia/commons/6/69/Cholinergic_neurons_of_the_nucleus_basalis_of_Meynert.jpg

Acetylcholine neurons in the brain Acetylcholine containing neurons in the nucleus basalis of Meynert of the forebrain. Loss of acetylcholine neurons in this structure have been implicated in dementia and Alzheimer's Disease.



Science Photo Library/Alamy Stock Photo

Dopamine neuron A dopamine neuron like this one, and how it communicates synaptically with other neurons, may be permanently altered after repeated exposure to older nootropics such as amphetamine.



Source: Mesulam, M. M., Lalehzari, N., Rahmani, F., Ohm, D., Shahidehpour, R., Kim, G., ... & Geula, C. (2019). Cortical cholinergic denervation in primary progressive aphasia with Alzheimer pathology. Neurology, 92(14), e1580-e1588

Loss of acetylcholine neurons with Alzheimer's disease The dark-stained lines show axons from acetylcholinergic neurons in the cortex. The panel on the left is from a healthy brain. In the right panel, these axons are significantly decreased in the brain of a person who has Alzheimer's disease.

This principle applies to people as well as plants. It is essential to realize that knowing someone's group membership tells you *nothing* about that person's actual intelligence. Failing to distinguish between individual performance and group norms can mislead people, produce incorrect expectations, and cause social injustices—and is prejudicial.

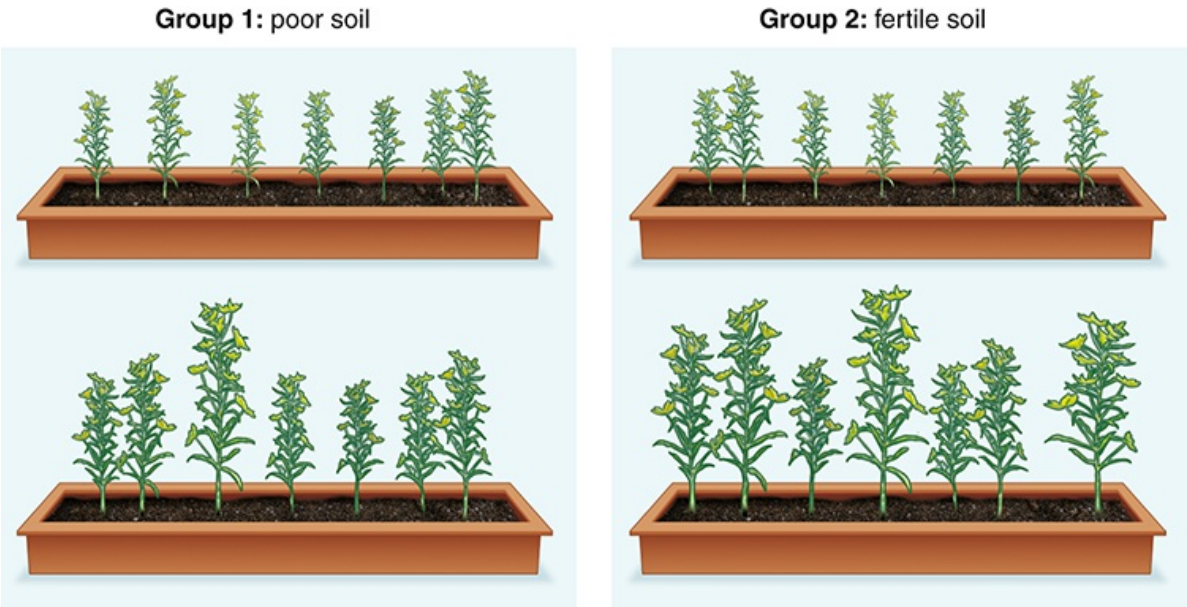


FIGURE 10.8 Lewontin's plant analogy of intelligence **If two groups of plants start out from the same source of seeds (genetics), but one group is given a better environment, the differences in height between the two groups would be mainly determined by environmental conditions. The analogy applies when evaluating group differences in IQ scores.**

With this analogy in mind, let us return to the question of IQ scores and group differences. Lorenzo Cherubini and his colleagues at Brock University have looked in detail at the situation of Indigenous education policy and practice in Ontario. They note that there is a significant gap between the levels of school success of Indigenous and non-Indigenous students, with Indigenous students twice as likely to drop out and fail to complete or take much longer to complete secondary school. He argues that equal education opportunities do not just consist of attending the same schools, but require that Indigenous children and youth work in school systems that acknowledge and celebrate Indigenous values and heritage. This will ensure that positive identity and commitment to education and learning will be a more consistent part of the Indigenous student experience (Cherubini, 2014; Cherubini & Hodson, 2012).

Such research suggests that public policy aimed at making more equitable resources available throughout society would lead to more similar intelligence test scores across different groups (Nisbett et al., 2012). Of course, this raises yet another important question: do efforts to equalize educational experiences and other environmental resources actually improve intelligence? We will consider next the effects of *environmental enrichment*—providing disadvantaged children with more stimulating environments at home and at school (see Positive Psychology 10.1).

10.1 Psychology Around Us | Positive Psychology

Are Smart Nations Happier?

Higher intelligence scores are correlated with an overall higher sense of happiness in

several countries, especially Western countries, but is this true for all countries around the world? In a recent study by Stolarski and colleagues (2015), they showed that this correlation between intelligence as a nation and national happiness scores were modulated by the economic growth of the country in question and whether the country is based on an individualistic versus collectivist societal structure. In Western individualistic societies, in contrast to more collectivist Eastern societies, individuals often seek personal happiness and satisfaction by pursuing goals such as education, professional achievement, and wealth. In Western countries, intelligence, broadly defined, is an essential ingredient for attaining these goals. In contrast, collectivist nations are more likely to find personal satisfaction from the bonds they make with others and by feeling part of a larger community. So IQ in the way we often think of it in the West may not be as important for happiness. Interestingly, this relationship between IQ and happiness is only found at the national level. When scientists have analyzed the relationship of IQ and happiness at the individual level, the correlation breaks down (Veenhoven & Choi, 2012). One question that remains to be asked, however, is whether the measures of IQ used by researchers in individualistic cultures are the appropriate measures of IQ to use in a collectivist society. More work in this area needs to be done.

BOISVIEUX Christophe/hemis.fr/Alamy

Smiles, smiles and more smiles **The pursuit of happiness in many collectivist nations, via the development of interpersonal relationships, is a critical aspect of their personal well-being.**

Does Environmental Enrichment Make a Difference?

Studies have indicated that young children from poor families typically receive less intellectual stimulation than do children from wealthier homes (Cooper, Crosnoe, Suizzo, & Pituch, 2010; Duncan, Magnuson, & Votruba-Drzal, 2014; Votruba-Drzal, Miller, & Coley, 2016). They have, on average, far fewer books and educational toys, for example, and their parents read to them less. Only half of preschoolers from families on public assistance have alphabet books, compared with 97 percent of children from wealthy homes (Chambers,

Cheung, & Slavin, 2016). It appears that their early environmental limitations may place poor children at a severe disadvantage when it comes to developing intellectual and academic skills.

We can see this problem particularly clearly in institutional settings such as orphanages and in foster homes (Beckett, Castle, Rutter, & Sonuga-Barke, 2010; Dozier, Zeanah, Wallin, & Shauffer, 2012; Nelson, 2014). During the early 1980s, psychologist J. McVicker Hunt (1982) conducted work in a poor Iranian orphanage. In an effort to improve the lives of children in the orphanage and, in turn, improve their development, he offered a program of "tutored human enrichment" (for example, basic cognitive and vocabulary instruction). He found that such early interventions did indeed help improve the cognitive functioning of the children. In other work, however, he clarified that early instruction of this kind helps to improve the intellectual capacities only of children who have been living in deprived environments, not of those who have already been living in enriched environments.

Based on findings such as Hunt's, *Project Head Start*, a United States federally funded preschool program, was launched in 1965 (see photo). The program, which has served more than 22 million disadvantaged children since its inception and now serves around one million each year, aims to enhance children's performances in school and beyond by helping to develop their cognitive and social skills as early as possible (USDHHS, 2011a, 2011b; Harvey & Miller, 2017; Hines, 2017) and by reducing their involvement with child welfare (Green et al., 2014). While there are some questions about its long-term effect (Protzko, 2016), the program continues to enjoy significant community and political support.

Jim West/PhotoEdit

Getting a head start **Two toddlers enjoy the individualized attention provided by their teacher and their ultra-stimulating classroom environment in a Head Start program in Mississippi.**

Early intervention programs can extend beyond school settings. They can include going into the homes of young children; working with their parents; adding stimulating toys, books, and tools to the home; and otherwise enriching the home and community environments. It appears that such home-bound programs often help increase children's cognitive achievements. In fact, work in Canada with Indigenous children has shown

promise for their long term health and education outcomes (START, W.I.A.H., 2016). Early intervention programs that identify and offer support to new, at-risk families in the form of weekly visits from a healthy family home visitor have been successful in getting children and their families onto a better starting track toward intellectual and educational success. Enrichment-intervention programs of various kinds achieve greater success when they: (1) begin earlier in life and continue (see Positive Psychology 10.2); (2) are more intensive (more hours per day and more days per year); and (3) include programs for maintaining positive attitudes and behaviours (Barnett, 2011; Conti, Heckman, & Pinto, 2016; Pungello et al., 2010).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

17. What are the main arguments of *The Bell Curve*?

18. About what percentage of intelligence is thought to be genetically determined, and what evidence supports this claim?

19. What types of environmental factors have been shown to affect intelligence?

What Do You Think? • Considering the material you have read about test construction, heritability, and cultural differences, what type of learning environment would maximize the intelligence of all individuals?

10.2 Psychology Around Us | Positive Psychology

Read a Book!

How biology and environment interact to influence a person's intelligence has been studied for decades. One way to determine the role of environment on classic measures of intelligence (WAIS testing) is to follow monozygotic twins, who are genetically identical and grow up in a similar environment. If a difference in IQ scores is found between identical twins, then we can hypothesize that something in the environment where they are growing up may be the reason for their differing IQ scores. Scientists have found that the differences in IQ scores between monozygotic twins tend to be stable over time. These differences are also found across a wide range of measures of intelligence and correspond to stable differences in personality and attitudes toward school (von Stumm & Plomin, 2018). While still debated, one of the key behaviours that may influence the differences in IQ scores between monozygotic twins is how much they read deeply (Bailey & Littlefield, 2017; Ritchie, Bates, & Plomin, 2015). We do know that IQ scores improve in individuals who go to school longer, with each additional year of education leading to a 1- to 5-point increase in IQ. While it is possible that this increase in IQ with added years of education is due to differences in the IQ of individuals before they start school, a recent meta-analysis shows that this is not the likely explanation (Ritchie & Tucker-Drob, 2018). Again, it

may come back to reading.

A recent study in Spain examined how reading and reading comprehension abilities correlate with a second type of intelligence: emotional intelligence (EQ). The study conducted in a high school over a two-year period found that an increase in reading books led to an increase in reading comprehension, and an increase in EQ (del Pilar Jiménez, Alarcón, & de Vicente-Yague, 2019). Whether you are considering reading a book to learn something new, to relax and escape from the everyday with romance, or to be pulled into yet another murder mystery, reading in any form is likely good for you.

LeventeGyori/Shutterstock.com

Kids love books **One of the best ways to boost intelligence, cognitive abilities, and academic achievement may be to read a book!**

The Brain and Intelligence

LEARNING OBJECTIVE 5

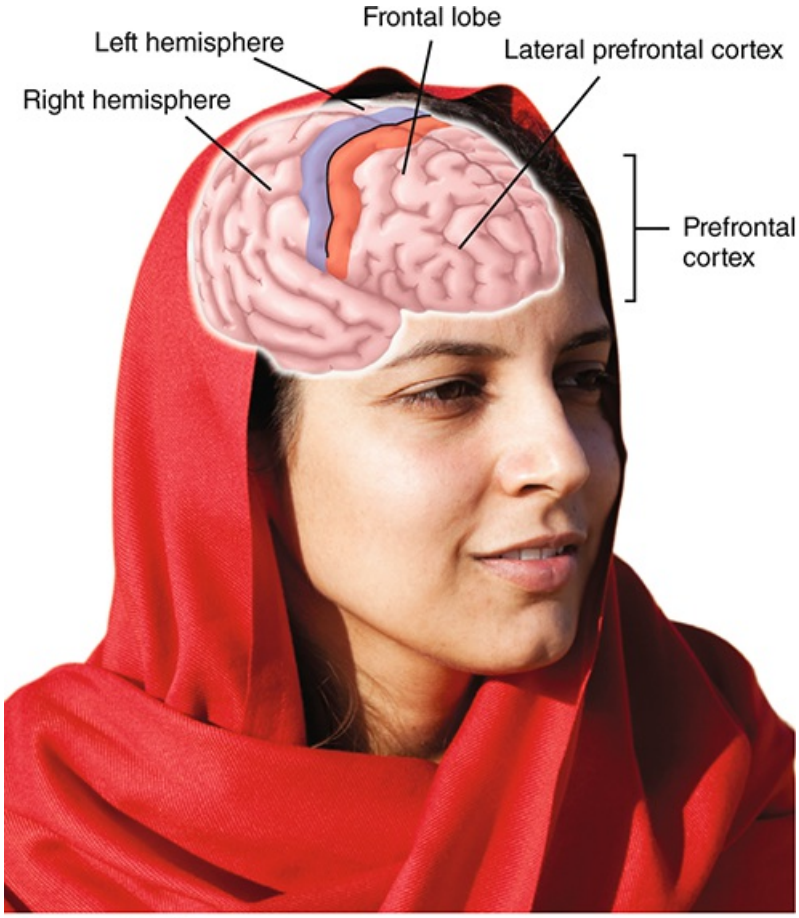
Describe how brain size, number of neurons, processing speed, brain activity, and cortical maturation relate to intelligence.

In this chapter, we have explored several important questions concerning the nature, measurement, and sources of intelligence. We now add another question: what happens in the brain when we exhibit intelligence? Have researchers, for example, detected relationships between specific brain activities or specific brain structures and intelligence? To answer this question, let's look at four areas of investigation: brain size, the processing

speed of neurons brain activity, cortical thickness and neuron density (Dicke & Roth, 2016).

Brain Size, Number of Neurons, and Intelligence

Researchers have been exploring correlations between brain size and intelligence since the mid-nineteenth century (Ash & Gallup, 2008; Galton, 1948, 1888). Initially, limitations in technology hampered meaningful outcomes. For example, researchers could only study the brains of corpses, which certainly made it difficult to test their intelligence. Today's neuroimaging technologies, however, allow scientists to measure brain size and brain activity in many animals, including living people (Roth & Dicke, 2012).



selimaksan/Getty Images

FIGURE 10.9 Brain neurons and intelligence Studies have suggested, for example, that general intelligence may be tied to the number of neurons in the brain's frontal and parietal lobes.

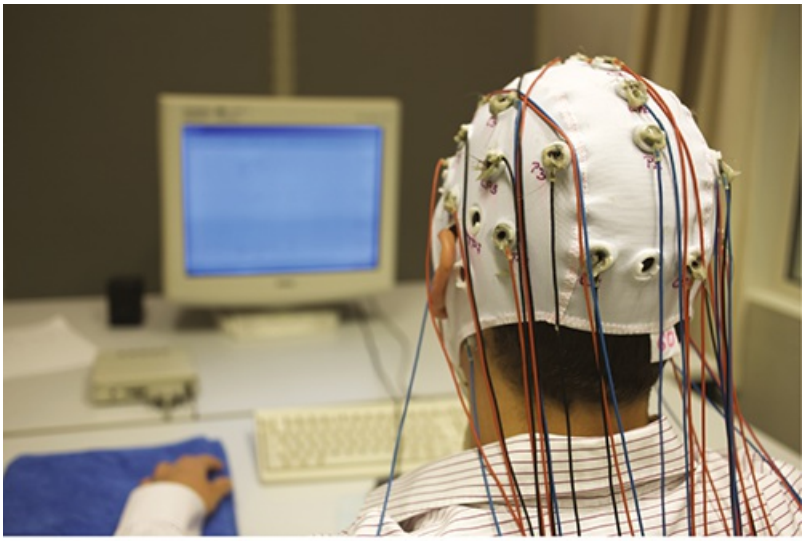
Some neuroimaging findings over the past few decades have indeed suggested a possible correlation between brain size and mental functioning, but most studies of this issue fail to support this notion (Basten, Stelzel, & Fiebach, 2013; Pietschnig et al., 2015). The main exception to this are people with extremely small (a condition called microcephaly, defined as two standard deviations or more below average head size) or extremely large brains (megalencephaly, defined as two or more standard deviations above average head size), each of whom are more likely to exhibit intellectual disabilities than are people whose

brain sizes fall within the normal range (Pirozzi, Nelson, & Mirzaa, 2018).

Regardless of brain size, does the total number of neurons in a brain predict intellectual functioning? No. On the other hand, intelligence may be related to the number of neurons in particular brain regions. Studies have suggested, for example, that general intelligence may be tied to the number of neurons in the brain's frontal lobes (see **Figure 10.9**) (Basten, Hilger, & Fiebach, 2015; Colom et al., 2013). All other things being equal, people with more such neurons seem to perform better on intelligence tests.

Processing Speed of the Brain and Intelligence

As discussed in Chapter 3, one way that researchers can analyze the bioelectrical activity of the brain is by using an *electroencephalogram* (*EEG*), a device that places sensors on the outside of an individual's head and records *brain waves*. EEG allows investigators to see whether intelligence is correlated with brain speed—the speed with which the brain responds successfully to various stimuli, tasks, and events (Sternberg, 2003; Haier, 2016). (See photo.)



©fotografixx/E+/Getty Images

Speedier brains? People who score higher on intelligence tests tend to perceive correct images more quickly, as indicated by EEG readings.

One procedure, for example, involves the speed at which people process stimuli that are flashed before their eyes. In a typical study, the experimenter briefly flashes an incomplete stimulus on one side of a screen and then quickly flashes a more complete stimulus on the other side. Viewers are asked to indicate which side the complete image appeared on. It typically takes only a fraction of a second to correctly answer this question. Still, some people are quicker than others, and those who perceive the correct image more quickly (as indicated by their EEG readings) tend to score higher on intelligence tests (especially on perceptual tasks) than those whose reactions are a bit slower. In short, more intelligent people may be physiologically wired to acquire and use information more quickly than others.

In a related line of research, several investigators have found significant correlations

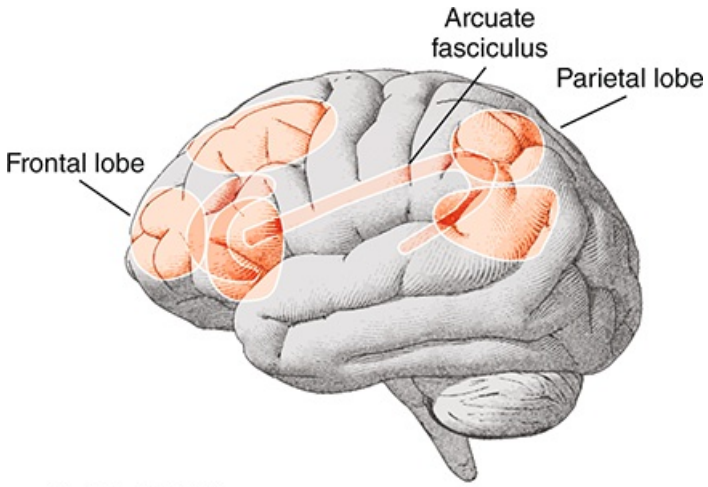
between IQ scores and **nerve conduction velocity (NCV)**, the speed with which electrical impulses are transmitted along nerve fibres and across synapses (Haier, 2016). Both the NCV and EEG findings fit well with studies showing that highly intelligent people are, on average, able to make decisions more quickly than less intelligent people (Demaree, Burns, & DeDonno, 2010; Thatcher, Palmero-Soler, North, & Biver, 2016; O'Brien & Tulsky, 2008). While nerve conduction velocity is important, please remember that this data is correlational not causal. Other neurological factors are also important for understanding how intelligence is coded into our nervous systems.

> **nerve conduction velocity (NCV)** the speed with which electrical impulses are transmitted along nerve fibres and across synapses.

Brain Activity and Intelligence

Another biological approach to the study of intelligence examines how active people's brains are when solving intellectual problems. In Chapter 3, we introduced the fMRI imaging technique. Recall that an fMRI scan is a type of neuroimaging technology that assesses where oxygen is being used in the brain every second. This is done by monitoring blood flow, which carries oxygen, among other things, to the areas of the brain that are the most active. The higher the use of oxygen in a specific area, the higher we assume the activity of the brain area in question. The flow of oxygen-rich blood to an area is assessed in a resting state and in a state of activity—for example, when lying quietly versus reading a passage from a Harry Potter book. The activity in the brain during resting state is subtracted from the active state to determine what areas are more active during a given task (Glover, 2011). While it may seem counterintuitive, brain activation during a cognitive task is often lower in individuals who score higher on tests of intelligence and cognitive performance (Graham et al., 2010). This has led to the development of the **neural efficiency hypothesis**. Some researchers suggest that the brains of higher-performing people do not need to work as hard as the brains of lower-performing people—that is, their brains are more efficient (Basten, Hilger, & Fiebach, 2015; Beaty et al., 2016; Haier, 2016; Horwitz et al., 2019).

> **neural efficiency hypothesis** the hypothesis that bright individuals show lower brain activity than less bright individuals during tests of low to moderate cognitive difficulty.



The Scientist Staff

FIGURE 10.10 Brain Areas and Intelligence Current models of intelligence suggest that the integration and processing and integration of information between the parietal and frontal lobes (areas in orange) is key for understanding how intelligence is coded and processed within the brain. The arcuate fasciculus is one of several brain structures that connects the frontal and parietal lobes allowing for the transfer of information between these two lobes.

Although high intellectual performance seems to be related to an overall reduction in brain activity, fMRI scans have revealed that particular areas of brain activity are at work during certain types of intellectual tasks. The prefrontal cortex, which sends and receives information to and from numerous other brain sites (see **Figure 10.10**), may help people keep track of several thoughts at the same time, solve problems, produce new ideas, and filter out unimportant information. Interestingly, these patterns of activation may differ between males and females. This does not mean there is a difference in intelligence between genders, but rather that males and females may use different brain circuitry or connections when solving certain cognitive problems (Jiang et al., 2019). Activation of the prefrontal, frontal, and parietal cortices have been well demonstrated in studies where imaging of brain activation has been conducted in conjunction with tests of various types of cognitive and creative intelligence (Kleibeuker et al., 2013; Saxe, Calderone, & Morales, 2018; Shi et al., 2020). This raises the question of whether the varied patterns of brain activation used during a cognitive task are important for understanding the neurological basis of intelligence. Some researchers are focusing on whether those with high intelligence have greater access to more complex and varied neural states, or neural connections and networks—a process called **brain entropy**—during cognitive tasks. For example, a classic question that may be used to assess mental processing is to name all of the vegetables and fruits you can think of that begin with the letter *s* in 60 seconds. (Take a minute and try it!) The more neural pathways, and cognitive maps, that you activate as you answer the question, presumably the more items you listed and the higher your brain entropy state was as you came up with your answers. A respected scientist in neural networking and intelligence, Aron Barbey (2018, p. 18), stated that, "general intelligence—which gives rise to the stunning diversity and uniqueness of human identity and expression—originates from the network organization of the human brain." It is how the activation of networks between brain structures, in areas such as the frontal and parietal cortices, occurs that may

be most important when it comes to understanding the role of brain activity in intelligence (Saxe, Calderone, & Morales, 2018; Shi et al., 2020; Williams, 2018).

> **brain entropy** the number of neural states, or neural configurations, a brain can access during a task.

While such studies are interesting, keep in mind that they do not clarify the causal relationships at work. For example, do people of higher intelligence display less brain activity overall, despite experiencing more activity in the prefrontal cortex, because they are smart, for example, or are people smart because their brain activity is more efficient? Or are both brain activity and intelligence related to yet a third causal factor that researchers have yet to discover? It will be interesting to see what the neuroscience of intelligence reveals about the activation and connections between the different brain structures you learned about in Chapter 3, as research continues in this area.

Cortical Maturation and Intelligence

We have seen that various brain features, such as the number of neurons, brain processing speed, and brain activity, may be tied to intelligence. A related issue is how *brain development* is related to the development of intelligence. A highly publicized and classic study by researcher Philip Shaw and his colleagues sought to answer this question (Shaw et al., 2008, 2006).

In a longitudinal study, the Shaw team performed brain scans on 309 children and teenagers between the ages of 6 and 19 years, with each participant scanned every two years (Shaw et al., 2008, 2006; Raznahan et al., 2013). The scans revealed that throughout childhood and adolescence, individuals display changes in the thickness of the *cortex*—the folded outer layer of the brain—changes that may have implications for the development of intelligence (Karama et al., 2011).

Using a neuroanatomical MRI scan (which shows only structural changes in the brain, not activity like an fMRI scan, which was described in the previous section), Karama et al. (2011) found that children begin with a thin cortex, which then thickens over the years and following this initial thickening then begins to thin down and continues thinning through adolescence. These changes in thickness are consistent with what is known about *neural pruning* during development. The brains of very young children produce a large number of neural synapses and neurons. As the children grow older, their brains prune the neural connections that are not being used, leaving the individuals with a much lower number of connections and, perhaps, neurons, in their teenage and adult years (see photos). It is believed that a thicker cortex may reflect a higher number of neural connections and neurons, whereas a thinner cortex may reflect a lower number; so as adolescence approaches and pruning occurs, the cortex typically becomes thinner. The study further found this pattern of changes in cortical thickness to be clearest in the prefrontal and parietal regions of the brain, areas closely related to intellectual activity. Thus, it appears that the development of intelligence may involve a process of synaptic and neural growth and then pruning, particularly in the prefrontal cortex.

Beyond this general picture, Shaw and his colleagues (2008, 2006) found that the

participants who were most intelligent showed a pattern of cortical thickening and thinning that was different from the pattern shown by participants with lower intelligence. That is, the highly intelligent individuals began with a rather thin cortex during early childhood, and the cortex gradually thickened until the age of 11 or 12, at which time thinning began and continued into the late teenage years. In contrast, the participants with lower intelligence began with a somewhat thicker cortex, which then further thickened until the age of 8, at which time the thinning began. Assuming that all of this reflects growth and pruning of neural connections, particularly in the prefrontal and parietal cortex, it may be that the processes of growth and pruning unfold over a much longer developmental span in highly intelligent people than they do in less intelligent individuals, perhaps because more complex and sophisticated neural circuits are being constructed (Schnack et al., 2015).

PeopleImages/Getty Images

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Moving up the ladder **As children develop, they move toward greater intellectual independence—for example, from a child whose father reads her stories to a young woman who produces and reads her own stories. Over the same period of time, the individual's brain is losing and developing neural connections as the brain matures into its final adult state.**

Are such brain changes over the course of childhood and adolescence genetically predetermined? Once again, the answer is "Not necessarily." The formation and pruning of neural networks are closely tied to interactions with the environment. Moreover, earlier in this chapter, we observed that enriching the environments of deprived young children often increases their intellectual performances. A recent study of cortical development and IQ found that the strongest association with IQ was parental education, not changes in the volumes of specific brain areas (Lange et al., 2010). Parental income also correlates to cortical development. The higher the parents' income, the greater the cortical surface area in parietal and frontal lobes, especially in children from lower-income families. It could be that people with particularly high intelligence tend to be raised in rich social and learning environments, and that this kind of environmental stimulation contributes heavily to the pattern of cortical thickness change that such individuals display (Brito & Noble, 2014; Brito, Piccolo, & Noble, 2017; Noble et al., 2015).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

20. How are brain size and number of neurons related to intelligence?

21. How do researchers measure the speed of information processing in the brain? How is this related to intelligence?

22. Is efficient processing linked to relatively lower or relatively higher activity in the brain?

23. What is the role of cortical maturation in the development of intelligence?

What Do You Think? • Can you think of any other ways to explain why the brains of people who are performing better on intelligence tests are often less active than those of people who are doing poorly?

Extremes in Intelligence

LEARNING OBJECTIVE 6

Discuss intellectual disability and giftedness.

Earlier in the chapter, we mentioned that intelligence, as measured by IQ tests, follows a normal distribution—that is, a distribution shaped like a bell curve. At either end of this curve are a small number of people who score either much lower or much higher than the people who make up the large middle. At the lower end are people who are diagnosed with intellectual disabilities, and at the higher end are those who are intellectually gifted (see **Figure 10.11**).

Intellectual Disability

Most individuals demonstrate sufficient levels of intelligence to survive on their own and to manage their daily lives. But the intellectual and adaptive functioning of some people is well below that of most other people. These individuals are said to display **intellectual disability**, a combination of general intellectual functioning that is well below average and poor adaptive behaviour (APA, 2013). That is, in addition to having an IQ score of 70 or below, many of these individuals experience great difficulty in areas such as communication, home living, self-direction, work, and safety (APA, 2013).

intellectual disability term describing individuals who display general intellectual functioning that is well below average and, at the same time, poor adaptive behaviour.

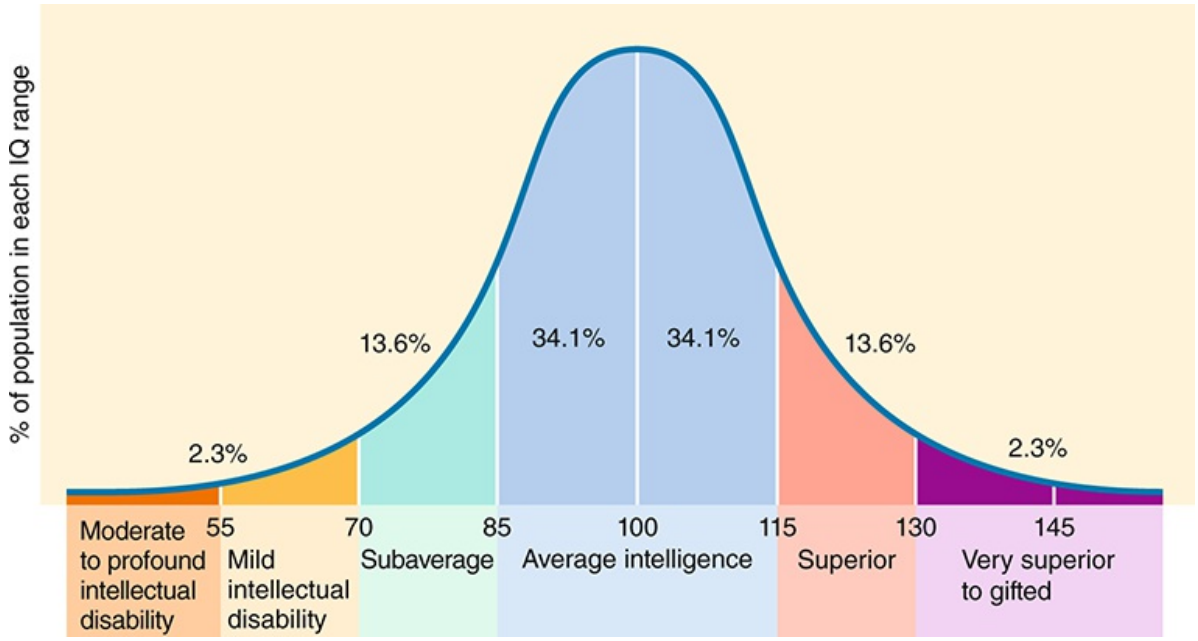


FIGURE 10.11 Extreme scores in intelligence A small but equal number of people score at the extreme low and extreme high end of the IQ range.

Source: Anastasi & Urbina, 1997

Markus Moellenberg/Corbis/GettyImages

Hayley Madden/Getty Images

Making music A young man with Down syndrome is the percussionist in a community orchestra (left), while a child prodigy sings opera at a school for the arts (right).

We have already observed that IQ tests and scores may be biased in various ways. It is certainly plausible that diagnoses of intellectual disability based on such tests can be subject to error (Tomes, 2010; Toth & King, 2010). Thus, to properly diagnose intellectual disability, mental health professionals must observe the functioning of an individual in his everyday environment, taking both the person's background and the community's standards into account (see photos).

The most consistent sign of intellectual disability is very slow learning (Toth & King, 2010). Other areas of difficulty include attention, short-term memory, planning, and delays in

language skills (Bertelli, Cooper, & Salvador-Carulla, 2018; Edgin, Pennington, & Mervis, 2010; Harris & Greenspan, 2016; Schalock et al., 2010). These difficulties vary, of course, according to the level of intellectual disability.

zudin/Getty Images

Intellectual disability and work **Sheltered workshops provide a broad range of vocational tasks and training opportunities for individuals with varying degrees of intellectual disability, leading, for many, to gainful employment.**

Because of the biases already noted in IQ assessments and scores (especially as they relate to community, linguistic, and cultural diversity), the Canadian Association of Community Living prefers to identify degrees of intellectual disability according to the level of support the person needs—intermittent, limited, extensive, or pervasive.

Around 80 to 85 percent of all people with intellectual disability fall into the category of mild disability (Dusseljee et al., 2011; Harris, 2010). Mild intellectual disability is often not recognized until children enter school. These individuals have reasonable language, social, and play skills, but they need assistance when under stress—a limitation that becomes increasingly apparent as academic and social demands increase. Often the intellectual performance of individuals with mild intellectual disability improves with age; some even stop meeting the criteria for the label after they leave school (Toth & King, 2010) Their jobs tend to be unskilled or semi-skilled.

Research has linked mild intellectual disability mainly to familial factors, particularly poor and unstimulating environments, inadequate parent–child interactions, and insufficient learning experiences during a child's early years (Martin 2010). In addition, studies suggest that a mother's moderate drinking, drug use, or malnutrition during pregnancy may lower her child's intellectual potential (Dow-Edwards, 2018; Hart, Ksir, & Oakley, 2010; Langridge et al., 2013).

Around 10 percent of persons with intellectual disability receive a label of *moderate intellectual disability*. They receive their diagnosis early in life, typically demonstrating

clear deficits in language development and play during their preschool years. By middle school, significant delays in the acquisition of reading and number skills and deficits in adaptive skills become apparent. By adulthood, however, many individuals with moderate intellectual disability are able to adequately communicate and care for themselves, benefit from vocational training, and work in unskilled or semi-skilled jobs (see photo). Most of these individuals also function well in the community if they have some degree of supervision (Trembath et al., 2010; Petner-Arrey, Howell-Moneta, & Lysaght, 2016).

Many persons with moderate intellectual disability have **Down syndrome**, the most common of the chromosomal disorders leading to intellectual disability (Hazlett, Hammer, Hooper, & Kamphaus, 2010). Fewer than of every 1,000 live births result in Down syndrome, but this rate increases greatly when the mother's age is over 35 (Centers for Disease Control, 2016). The syndrome usually is caused by the presence of extra chromosomal material on the twenty-first chromosome. The additional material changes normal development, resulting in characteristic features such as a small head, flat face, slanted eyes, high cheekbones, and reduced intellectual functioning (Asim et al., 2015). More generally, they display the same range of personality characteristics as people in the general population (Fidler & Daunhauer, 2011; Grieco et al., 2015).

> **Down syndrome** an inherited disorder, usually caused by the presence of extra chromosomal material on the twenty-first chromosome, that results in intellectual disability.

Approximately 3 to 4 percent of people with intellectual disability meet the criteria for *severe intellectual disability*. They typically demonstrate basic motor and communication deficits during infancy. Many have an increased vulnerability to seizure disorders. They usually require careful supervision, profit from vocational training to some degree, and can perform only basic work tasks in structured and sheltered settings. Most are able to function well in the community if they live in group homes, in assisted living facilities, or with their families (Cain et al., 2010; Petner-Arrey et al., 2016).

Around 1 to 2 percent of people with intellectual disabilities receive a diagnosis of *profound intellectual disability*. Their limitations are very noticeable at birth or early infancy. With training, the individuals may develop or improve basic skills such as walking, may develop more expressive language, and may be able to feed themselves. They require a very structured environment, with close supervision and considerable help, including a close relationship with a caregiver, to develop adequately (Cain et al., 2010; Baroff & Olley, 2014). (See Indigenous Experiences 10.2.)

Giftedness

Psychologists do not agree on how to define *giftedness* (Sternberg, 2016a; 2017). Some researchers use IQ tests as the sole criterion, defining the top 1 or 2 percent of the tested population as gifted. For example, Lewis Terman defined gifted people as those with IQ scores above 140, and in a famous longitudinal study, he followed a group of gifted research participants over the course of their lifetime (Leslie, 2000; Terman, 1925).

The Tennessean, Rex Perry/AP Images

Educating the gifted **A gifted 9-year-old girl sits in her college algebra class in Nashville, Tennessee. Although getting in and out of the adult-sized desk chair can be a problem, the algebra is a snap for her.**

Other researchers and educators have added criteria such as school success or career achievement to IQ scores when defining giftedness (see photo). Indeed, many of the participants in Terman's study, who became known as the "Termites," achieved extraordinary success as scientists, scholars, businesspeople, and professionals (Seagoe, 1975).

Other definitions of intelligence have led to still other definitions of giftedness. Howard Gardner, whom we discussed earlier in the chapter, suggests that people can be gifted with high intelligence in any one of the multiple intelligences he has identified. He would consider a highly talented athlete or musician to be as gifted as a math or verbal whiz (Gardner, 1993 a&b).

Researchers have tried to look for common characteristics among gifted people (Sternberg, Jarvin, & Grigorenko, 2011; Sternberg & Kaufman, 2018). They have come up with several:

> *Environment can contribute to giftedness*. Many gifted people are raised in nurturing and stimulating environments. Terman's Termites, for example, were typically members of upper socio-economic families, and they received many years of education. It is worth noting that, contrary to stereotype, most gifted children are not pushed by demanding parents. Families do, however, tend to centre much attention on such children. Typically, the parents first recognize the budding giftedness of their children and then support it by providing high-level intellectual or artistic stimulation.

Parents of highly gifted children also tend to have higher expectations of themselves, model hard work for their children, and grant the children high degrees of independence (Garn, Matthews, & Jolly, 2010; Witte, Kiewra, Kasson, & Perry, 2015).

Gifted people are often intrinsically motivated. It appears that children who are gifted at piano playing, violin playing, chess, bridge, athletics, and the like typically experience a deep, intrinsic motivation to master such domains and subject themselves to many hours of deliberate practice. Perhaps the high motivation of these children drives them and sustains their practice efforts. However, research has failed to show that gifted abilities necessarily precede extensive practice. Does this mean that a person of average intelligence and above-average motivation can readily become a concert pianist or astrophysicist? No. Other research indicates that hard work, intensive training, perseverance, and practice alone rarely lead to giftedness. In short, motivation and hard work seem to be necessary, but not sufficient, requirements for the development of giftedness (Clinkenbeard, 2012; Witte et al., 2015).

Some people gifted in academic or other forms of intelligence may not be equally gifted with social and emotional intelligence. Some psychologists have observed that gifted children often display disproportionate social and emotional difficulties, especially during adolescence. Many are socially isolated and introverted. In fact, a number of academically gifted children try to hide their giftedness in an attempt to fit in with others (Cross et al., 2019).

10.2 Indigenous Experiences

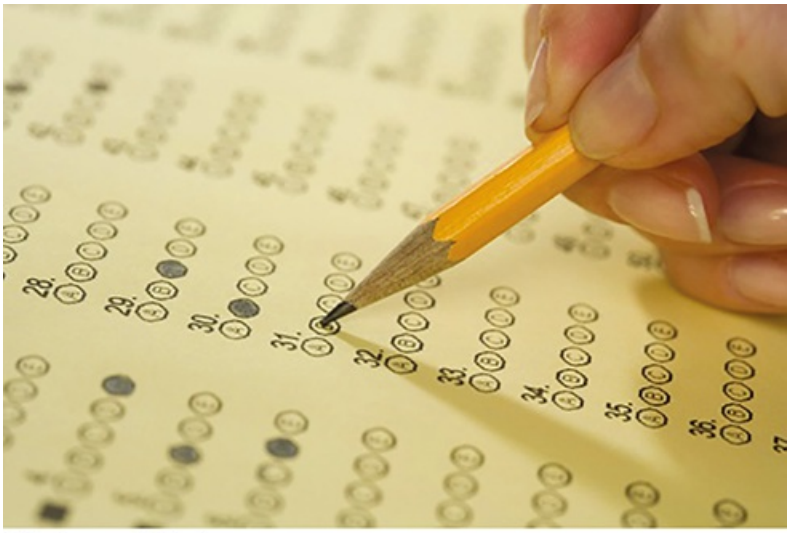
Assessing Individuals with Intellectual Disabilities in Indigenous Communities

The supports for individuals with intellectual disabilities (ID) in Indigenous communities are substantially behind those for non-Indigenous individuals with ID, which creates additional challenges for Indigenous individuals already facing racism. As well, since standardized cognitive assessments use population norms for purposes of comparison, and since those norms rarely include significant representation from Indigenous groups, interpreting cognitive assessment scores from Indigenous individuals with ID is very problematic.

Shahi Goyal and colleagues from the Surry Place Centre and Sioux Lookout First Nations Health Authority (2020) examined the cognitive profiles of Indigenous adults in northwestern Ontario. The study's goal was to develop a better understanding of Wechsler Adult Intelligence Scale—IV (WAIS-IV) scores from individuals diagnosed with ID who identified as Indigenous. Their results indicated that Indigenous individuals with ID scored significantly higher on perceptual reasoning than they did on verbal comprehension. Goyal et al. argue that the size of the difference between the two sets of scores suggests these individuals would have greater proficiency in understanding visual information and consequently would be significantly better at visual problem solving. This discrepancy in the two sets of scores is consistent with findings from typically functioning Indigenous and non-Indigenous people but differs from results obtained from non-Indigenous people diagnosed with ID. The authors

speculate that this difference between the two ID groups may be accounted for based on language of origin, cultural factors, differences in learning styles, or differences in parenting.

Results suggest that employing a strength-based approach for caregivers and educators (i.e., focusing on positive attributes rather than deficits), centred on hands-on learning, would be best practice for this Indigenous group (Goyal, Temple, Sawanas, & Brown, 2020). In addition, the reduction of verbal demands and a strong focus on experiential learning would also benefit this group across all settings (e.g., home, school, and work). Goyal and colleagues recommend speaking with Indigenous individuals with intellectual disabilities by slowing the rate of verbal conversations, requests, and commands. They suggest that such an approach would serve to increase connection and understanding, and to create a more positive relationship between the affected individual and caregiver or educator, and will also serve to increase motivation and cooperation on the part of the person with the disability.



Tetra Images/ Getty Images

Culture matters **The role of culture and ways of knowing is an important aspect of intelligence that must be taken into account when working with Indigenous peoples with intellectual disabilities.**

The authors (Goyal et al., 2020) caution against generalizing their findings to all Indigenous populations. Indigenous people represent a very disparate group; they come from different geographic locations, speak different languages, and have distinct histories and cultural experiences, and so these findings might differ from one group to another. This cautionary note underscores the strong role of environmental factors when diagnosing ID.

Critical Thinking Questions

How does the lack of support for Indigenous individuals with ID create additional challenges for them?

How does our current IQ testing disadvantage Indigenous peoples with ID?

What type of environmental factors need to be considered when working with Indigenous peoples with ID?

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

24. What are the four levels of intellectual disability, and which is most common?

25. What are some causes of intellectual disability?

26. Is high IQ the only criterion for giftedness?

What Do You Think? • How might environment produce the effect of intellectual disability? Do you think this effect could be reversed? If so, how? If not, why?

Summary

What Do We Mean by Intelligence?

LEARNING OBJECTIVE 1 Describe various ways in which intelligence has been defined and summarize the current thinking on whether intelligence is general or specific.

Scholars early in the twentieth century defined *intelligence* as the ability to learn and to meet the demands of the environment effectively. Later, other scholars added to this definition the ability to understand and control one's mental activities, called metacognition.

A central issue in defining intelligence is whether it is a single, general factor or a cluster of different abilities. Charles Spearman hypothesized that a general factor, or *g* factor, underlies all mental abilities, while Louis Thurstone argued that intelligence is made up of seven distinct *primary mental abilities*.

Although most theorists today agree that intelligence does include a *g* factor, modern theorists such as Howard Gardner, Robert Sternberg, and Stephen Ceci have tended to deemphasize the *g* factor and focus on specific abilities, or *s* factors.

How Do We Measure Intelligence?

LEARNING OBJECTIVE 2 Identify important considerations in the construction of intelligence tests, discuss the history of intelligence testing, and describe some criticisms of intelligence tests.

The *psychometric approach* to studying intelligence attempts to measure intelligence with carefully constructed psychological tests.

To ensure that intelligence tests are grounded in sound scientific principles, psychologists design tests that adhere to three basic criteria: *reliability*, *validity*, and

standardization.

Early pioneers of intelligence testing include Francis Galton, who proposed the theory of psychophysical performance, and Francis Binet, who developed a test to predict children's success in school.

Adapting Binet's work for use in the United States, Lewis Terman constructed the Stanford-Binet Intelligence Test and devised the *intelligence quotient* (*IQ*).

David Wechsler broadened the usefulness of intelligence testing by developing the Wechsler Adult Intelligence Scale (WAIS), along with several other tests.

Both the Stanford-Binet and the WAIS have high degrees of reliability. Performance on intelligence tests also correlates highly with school performance, and to some degree with other areas of functioning in life, such as occupational achievements.

Although widely used, intelligence tests are subject to several criticisms. One issue involves the culture-specific nature of the tests, which may produce bias. A related problem is *stereotype threat*.

Intelligence test scores from around the world have increased over time, a phenomenon known as the *Flynn effect*. Possible explanations include potential problems with the procedures, content, or nature of the tests and improvements in education, nutrition, health, or environments.

Additional Types of Intelligence

LEARNING OBJECTIVE 3 Discuss several proposed types of intelligence that go beyond intellectual functioning.

Other theorists have broadened the definition of intelligence further to include emotional intelligence, social intelligence, wisdom, creativity, and personality.

Creativity is strongly correlated with intelligence but intelligence is not sufficient for creative output. Creative output often requires an intrinsic drive to create as well as a strong imagination.

How Is Intelligence Influenced by Biological and Environmental Factors?

LEARNING OBJECTIVE 4 Review the contributions of biological and environmental factors to intelligence, and explain how emphasizing different factors can affect social policy.

The relative contributions of biology and environment to the development of intelligence has important social implications, exemplified by the controversial book *The Bell Curve*, whose authors argued that group differences in IQ are likely due at least in part to genetic factors.

Family studies and research in molecular biology have indicated that heredity does play a major role in intelligence. Researchers estimate that the heritability of intelligence is about 50 percent.

Environmental factors that affect intelligence include family and home, overall culture, occupation, and schooling.

Group differences in IQ scores enable us only to make distinctions between groups, not to reach any conclusions about an individual within a group.

Studies have confirmed that environmental enrichment for members of disadvantaged groups is effective in producing at least short-term cognitive gains.

The Brain and Intelligence

LEARNING OBJECTIVE 5 Describe how brain size, number of neurons, processing speed, brain activity, and cortical maturation relate to intelligence.

Neuroimaging studies suggest that overall brain size is not correlated with intelligence. The number of neurons in certain brain regions, such as the frontal lobes, may be related to intellectual functioning.

The speed with which the brain responds to stimuli, which can be measured by means of EEGs and *nerve conduction velocity* (*NCV*), also correlates with intelligence.

fMRI scans, which show what areas of the brain are active at a particular moment, have generally revealed lower activity in the brains of people performing well on an intellectual task and higher activity in the brains of people performing poorly. This suggests that the brains of the higher performers may be more efficient.

It appears that the development of intelligence involves a process of neuron growth and then neuron pruning, particularly in the parietal and frontal cortices—a process that is reflected by a distinct pattern of change in cortical thickness throughout childhood and adolescence.

Extremes in Intelligence

LEARNING OBJECTIVE 6 Discuss intellectual disability and giftedness.

The two extremes of intelligence, as measured by IQ tests, are represented by intellectual disability and giftedness.

Home environmental causes of intellectual disability include poor and unstimulating environments and inadequate parent–child interactions. These causes have been associated in particular with mild intellectual disability, though they may also be at work in more severe cases.

Other causes of intellectual disability include genetically based chromosomal abnormalities, certain prenatal conditions in the mother, complications at delivery, and injuries and infections during early childhood. These causes have been associated in particular with moderate to profound levels of intellectual disability.

Down syndrome is a genetic abnormality resulting in intellectual disability.

Psychologists do not agree on how to define giftedness, but often identify gifted persons as having IQs at the top 1 or 2 percent of the tested population.

Environment can contribute to giftedness, and gifted people are often highly motivated. However, academically gifted people may not be equally gifted with social and emotional intelligence.

Key Terms

bioecological model of intelligence
brain entropy
content validity
creativity
Down syndrome
emotional intelligence
factor analysis
Flynn effect
g factor
heritability
heritability coefficient
intellectual disability
intelligence
intelligence quotient (IQ)
mean
median
mental age
metacognition
mode
nerve conduction velocity (NCV)
neural efficiency hypothesis
normal distribution
predictive validity
primary mental abilities
psychometric approach
reliability
s factor
standardization
stereotype vulnerability or threat
theory of multiple intelligences
triarchic theory of intelligence

validity

validity coefficient

Self-Study Questions

Multiple Choice

1. Which of the following areas is not included in the definition of intelligence?

a. ability to communicate

b. ability to learn

c. ability to meet the demands of the environment

d. ability to understand and control our own mental activities

2. Which theory of intelligence could be described as most inclusive (meaning, considers the largest number and range of factors as part of the definition of intelligence)?

a. Ceci's bioecological theory of intelligence

b. Gardner's theory of multiple intelligences

c. Spearman's two-factor theory of intelligence

d. Sternberg's triarchic theory of intelligence

3. A manager at a retail store develops a test and uses it to hire new employees (only people who score high on the test will be offered the job). To examine whether people who do better on the test also perform better on the job, the manager should focus most closely on

a. content validity.

b. reliability.

c. the test distribution.

d. the validity coefficient.

4. Binet and Simon's intelligence test was created with the intention of

a. determining which groups of people are inherently more intelligent than others.

b. identifying gifted children for placement in advanced programs.

c. identifying which school placement level was most appropriate for different children.

d. using test scores to rank children according to abilities.

5. Considering the Stanford-Binet and WAIS intelligence tests, with which two sets of scores are we likely to obtain the highest correlation?

a. a set of test scores and the same people's grades in school

b. people taking the test at age 4 and the same people taking the test at age 40

c. people taking the test today and the same people taking the test two weeks from now

d. two groups of people who are unrelated to each other

6. Emotional intelligence includes which of the following abilities?

a. getting along with other people

b. perceiving others' emotions and our own

c. using emotional feedback to manage situations

d. using emotions to solve problems

7. According to researchers Bradley and Caldwell, which of the following is not a suggestion for how parents can improve their children's intelligence?

a. Avoid too much restriction and punishment.

b. Organize the physical environment and the child's activity schedule.

c. Provide appropriate play materials.

d. Set high goals and reward the child for meeting them.

8. Which of the following statements about school and intellectual development is true?

a. Children whose birthdays allow them to just make the cut-off for school attendance tend to struggle more than children who do not make the cut-off and are almost a year older when they start school.

b. Children with very high intelligence scores tend to drop out of school because they get bored.

c. Students' intelligence test scores tend to drop during the school year as they struggle to learn a lot of new information, and then rise during the summer when they are less stressed.

d. When children are moved from financially poor schools to more affluent schools, their intelligence test scores tend to increase.

9. Research using the electroencephalogram (EEG) and measures of nerve conduction velocity (NCV) have shown that

a. brain processing tends to be faster in those higher in intelligence.

b. it is impossible to determine the relationship between brain activity and intelligence.

c. the EEG is a more sensitive measure of brain processing efficiency than the NCV method.

d. the overall size of the brain is related to intelligence.

10. Gifted individuals tend to have all of the following characteristics except

a. a willingness to work hard, practise, and persevere when things get difficult.

b. access to stimulating and nurturing environments while growing up.

c. high levels of intrinsic motivation.

d. IQ scores between 100 and 130.

Fill-in-the-Blank

1. Psychologist Howard Gardner put forward the _____ which argues that there is not a single unified intelligence.

2. According to Sternberg, wisdom is most closely related to _____ intelligence.

3. On most intelligence tests, most people score in the middle, with a few at the very high or low ends of the scale. This pattern of scores is called a _____.

4. A child's _____ reflects the level of the child's intellectual performance, which may or may not match his chronological age.

5. A tendency called _____ occurs when individuals in particular groups know they are expected to perform poorly on a test and this expectation impairs their performance.

6. The fact that identical twins' intelligence test scores correlate more strongly than do fraternal twins' scores tells us that intelligence is at least partly _____.

7. Investigations of financially poor schools have demonstrated that the _____ of the school environment affects intellectual performance.

8. The number of neurons in the brain's _____ lobes seems to be related to intelligence.

9. Longitudinal research by Shaw suggests that changes in the thickness of the _____ have implications for the development of intelligence.

10. An important contributor to many cases of mild intellectual disability is the _____ of the individual.

CHAPTER 11
Motivation and Emotion

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CHAPTER OUTLINE

Theories of Motivation

LEARNING OBJECTIVE 1 Briefly explain each of the five major theories of motivation.

Biological Motivations: Thirst and Hunger

LEARNING OBJECTIVE 2 Summarize the factors that affect our motivation to drink and to eat.

Biological Motivations: Mate Choice and Sex

LEARNING OBJECTIVE 3 Describe factors that affect our motivation to choose a mate and to have sex.

Psychological Motivations: Individual Factors

LEARNING OBJECTIVE 4 Describe how unconscious/conscious, approach/avoidance, intrinsic/extrinsic, and fixed/growth mindsets affect our motivational drive.

Psychological Motivations: Affiliation and Achievement

LEARNING OBJECTIVE 5 Describe factors that influence our psychological motivations for affiliation and achievement.

What Are Emotions?

LEARNING OBJECTIVE 6 Define emotion, types of emotion, and the components, measurement, and functions of these emotions.

Theories of Emotion

LEARNING OBJECTIVE 7 Discuss the major theories of emotion, and identify the

pathways through which emotions are experienced according to each theory.

What About Positive Emotions?

LEARNING OBJECTIVE 8 Identify some factors that influence whether or not a person is happy.

"I don't want to die, but I accept that it can happen."

Caitlin Forsey (2009) wrote her University of British Columbia Master's thesis on the sport of BASE jumping (Buildings, Antennas, Spans, and Earth) (in which her boyfriend participates). BASE jumpers use a parachute to jump from a fixed object (i.e., a building, antenna, bridge, or cliff) rather than an airplane. It differs from skydiving in other ways as well. BASE jumpers need a chute that opens much faster than a regular skydiving chute because they often jump from objects at or below 150 metres (as compared to the 600 metres that experienced skydivers typically jump from). BASE jumpers do not carry a reserve chute; if their main chute does not work, well—it doesn't matter.

If jumping from a BASE with a parachute seems too tame, and not potentially lethal enough, you can always choose a wingsuit instead of a parachute (see photo at the beginning of the chapter). Wingsuits give a person the capabilities of a flying squirrel. To a young male (women jump, too, but it is typically young men), wingsuits may be the ultimate BASE jumping adrenaline rush, although your odds of dying in a BASE jumping accident, with a parachute or wingsuit, are reported to be approximately 1 in every 500–1,000 jumps. Due to its lethality, several countries have bans on BASE jumping. It is prohibited in all national parks in the United States, some areas of Norway, and the town of Chamonix in France, where the sport was banned after a BASE jumper crashed into an empty chalet and perished. If BASE jumping isn't your thing, you could try walking on the wings of flying airplanes, parkour, volcano boarding, or bungee jumping into water with crocodiles. If you are looking for a dangerous thrill, there are many options to choose from. As a note of caution, if you decide to try any of these sports please take appropriate training and safety precautions before participating in any of them.

Sports like BASE jumping make you wonder what motivates an individual to engage in such odd behaviour. Is it an adrenalin rush? Is it an emotional high? Most certainly, there is a lot of psychological research looking at why people get into extreme sports, with recent studies showing that extreme sports may promote psychological health in those who participate (Brymer & Mackenzie, 2017; Immonen et al., 2017; Feletti, Westman, & Mei-Dan, 2017; Kerr & Houge Mackenzie, 2020).

In this chapter we will examine the basic features of what motivates us and the emotions we feel. Both the terms "motivation" and "emotion" are derived from the same Latin root word—*motare* meaning to shake or to stir or to move with purpose. Psychologists define **motivation** as a condition that directs behaviour (Reeve, 2018). This behaviour is usually directed toward a goal. For any given circumstance, your behaviour is probably the consequence of a combination of several **motives**—your needs or desires.

motivation any internal process or condition that directs behaviour.

motive a need or desire.

Beyond motivation, human action is usually accompanied by emotions. How would you define emotion? Defining an emotion is difficult, even for those who study them. There are over 500 words in the English language that refer to various aspects or forms of emotions, from *affect*, to *mood*, to *feeling*. Given this, it will not be surprising to note that researchers studying emotion have trouble agreeing on a definition (Gendron, 2010; Scheff, 2015; Lewis, Haviland-Jones, & Barrett, 2010). Despite this lack of agreement, psychologists continue to believe that human motivation and emotions are among psychology's most important topics. We will begin with psychological theory and work-related to motivation and then, later in the chapter, turn to theories and research related to emotion.

Theories of Motivation

LEARNING OBJECTIVE 1

Briefly explain each of the five major theories of motivation.

Explaining people's behaviour has always been a core part of psychologists' research interests. Research regarding why we are motivated to do a behaviour has been challenging because motivation is an internal and often private experience. We cannot see your motivation for taking this course, or the reasons why you may be motivated to go out with friends rather than study for an upcoming exam. What scientists can do is observe and record what we can see and then make inferences about a person's motivations. Over the years scientists have devised several theories of motivation, each of which takes a different approach to explaining what compels individuals to act as they do (Table 11.1). However, while grand, unifying theories of motivation have been proposed (see end of this section), no agreement exists on what this theory may be (Baumeister, 2016; Dweck, 2017; Hattie, Hodis, & Kang, 2020; Reeve, 2016), and no single theory has yet been able to provide a complete explanation of what motivates us to engage in our many different behaviours.

TABLE 11.1

Major Theories of Motivation

Theory	Approach
Instinct	Behaviour is motivated by instincts that are inborn and that are activated by environmental stimuli
Drive reduction	Behaviour is motivated by biological needs to maintain the body in a state of balance or equilibrium
Arousal	Behaviour is motivated by the need to achieve optimum levels of arousal
Incentive	Behaviour is motivated by internal (intrinsic) or external (extrinsic) incentives or rewards
Hierarchy of needs	Behaviour is motivated by the current most basic need, when different motives compete; basic survival needs must be satisfied first before we are motivated to satisfy higher-level needs such as belonging and self-esteem

Instinct Theory

The Greek philosopher Epicurus argued that humans are born to instinctually seek pleasure (Gregory & Zangwill, 1987). Much later Sigmund Freud argued we both seek pleasure and avoid pain also on the basis of inborn instincts (Freud, 1991). Instinct theory maintains that behaviours originate from a set of behavioural blueprints, or **instincts** (Fancher, 1996). Instinctive behaviours are inborn and activated by particular environmental stimuli. A good example of instinctual motivation can be observed in the migratory behaviours of birds that do not have to learn where and when to fly when the seasons change (Heinrich, 2014).

instincts inborn behavioural tendencies, activated by stimuli in our environments.

Many of our own basic motives are inborn. Some of the most critical for survival, such as eating, are present at birth (Heckhausen, 2018; Smillie, 2013). Although the range of foods considered to be rewarding changes substantially from the time we are babies until our adult lives (infants will readily eat baby food and formula, both of which adults typically consider bland and unappealing), the basic motivation to eat when hungry persists throughout life.

temis/Getty Images

The grasp reflex **Infants will grasp onto a finger placed in the palm of their hand. Their grip and its strength are part of the automatic grasp reflex.**

Humans are also naturally motivated to form social contacts. As we saw in Chapter 5, babies are born with a well-developed sense of smell that lets them recognize the particular scent of their mothers (Schaal & Durand, 2012). Babies are also born with reflexes that allow them to engage in primitive social behaviour (see photo). The rooting reflex, discussed in Chapter 4, for example, involves turning the head and using the mouth to search for a nipple. Rooting not only helps a baby to eat, but it allows the infant to seek contact with other people. Along with enabling babies to recognize their mothers by smell, rooting enables babies to start establishing close relationships with their mothers (Lucas, Smith, & Gephart, 2015). As the baby grows, new abilities emerge, such as smiling, laughing, reaching arms out to be carried, and talking. All of these further encourage the formation of social bonds, thus increasing the chance of survival (Atzil, Gao, Fradkin, & Barrett, 2018; Meltzoff & Marshall, 2018). As with eating, the nuances of this basic motivation change as we grow. For example, instead of seeking motherly love, as adults we

seek romantic love. In one way or another, the motivation to be socially connected remains strong throughout life.

mayo5/Getty Images

Challenging a theory **This bungee jumper (like BASE jumpers) takes off from a bridge and begins a wild—and seemingly dangerous—free fall, challenging instinct theory along the way.**

Although instinct theory can explain some of our behaviour and a substantial proportion of animal behaviour, instincts don't account for all behaviour, even in relatively simple creatures, such as rats. In fact, studies on learning and memory would be impossible to carry out on laboratory animals if all of their behaviour was innate; the animals would never need to learn or remember anything.

Instinct theory also has trouble explaining differences among individuals (Bevins, 2001). Among humans, for example, some of us seek out experiences that others avoid or even find painful (see photo). Consider adventurers who have climbed Mount Everest, a gruelling and dangerous activity. Conversely, some individuals avoid experiences that others find rewarding and pleasurable. Some people drink alcohol while others do not, and some people exercise regularly while others do not. Clearly, these behaviours are not driven by instincts. We need other explanations for these motivations.

courtesy Canada's Wonderland

Challenging another theory **People riding the Behemoth roller coaster at Canada's Wonderland demonstrate the limits of drive-reduction theory.**

Drive-Reduction Theory

Drive-reduction theory is another attempt to account for motivation on the basis of internal biological factors. This theory is based on the concept of **homeostasis**, a general tendency of the body to maintain itself in a state of balance or equilibrium (**Figure 11.1**). When an external factor alters the state of balance in the organism, a motivation arises to correct that balance (Baumeister, 2016). A simple example of this can be seen in the response of the body to heat. When the temperature rises, your body perspires and you lose water. The perspiration evaporates and cools the surface of the skin, helping to maintain the temperature balance in your body. In addition, you may feel motivated to take actions that will hasten your return to an ideal body temperature, such as shedding some layers of clothing or getting a cool drink.

> **homeostasis** a tendency of the body to maintain itself in a state of balance or equilibrium.

Drive-reduction theory works well to explain behaviours related to biological needs, such as cooling off when we are too hot or getting a drink of water when we are thirsty. We engage in many behaviours, however, that do not appear to be motivated by a need to keep the body in a state of equilibrium. In fact, some human behaviour is designed to do just the opposite. Some people seek out adventurous situations that are designed to thrill and even terrorize for entertainment. Amusement park owners and the makers of horror films make millions of dollars every year providing an outlet for this sort of interest. It's difficult to explain the motivation to go on the West Edmonton Mall's Mindbender roller coaster or the

Behemoth roller coaster at Canada's Wonderland in terms of a need to restore the body to a state of equilibrium (see photo). Instead, the main purpose is to experience excitement by throwing riders suddenly *out* of a state of emotional equilibrium. That type of thrill-seeking behaviour may be better described in terms of another theory (Giddy & Webb, 2018; Torres, Milman, & Park, 2019). More recently, research into the motivations for space tourism have found that thrill seeking and risk taking are one of the leading drivers for individuals who wish to leave this planet (Laing & Frost, 2019).

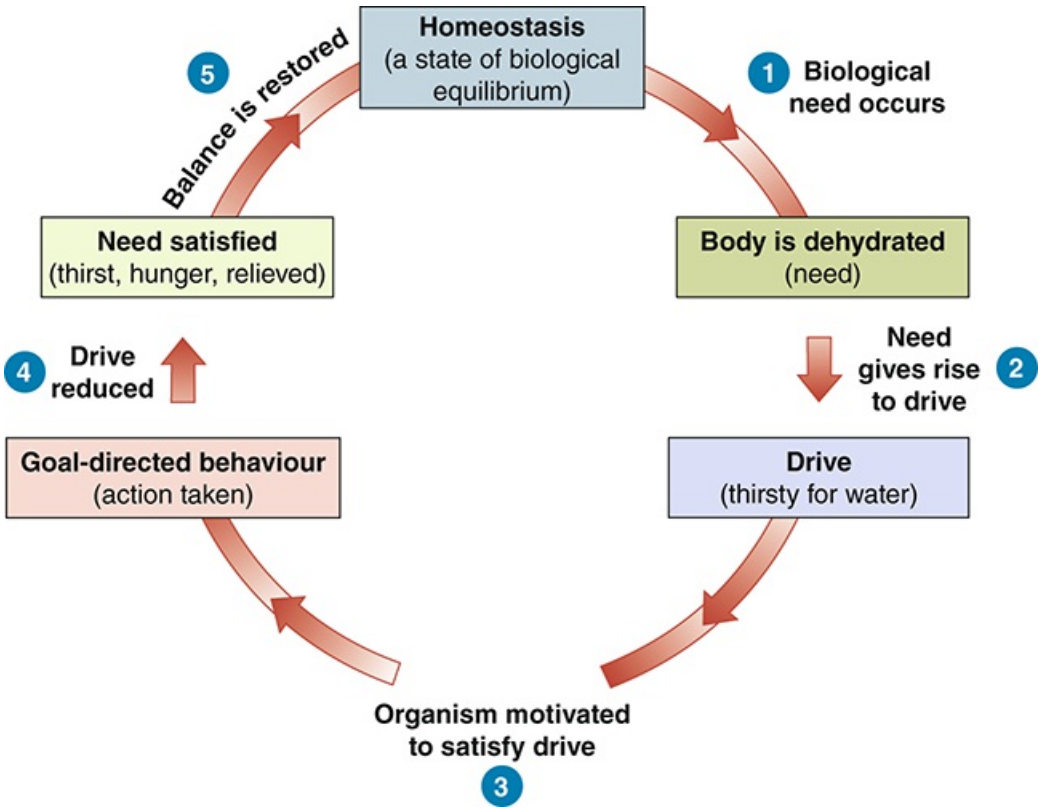

FIGURE 11.1 Drive-reduction theory When external factors alter our body's normal state of equilibrium, we are motivated to behave in ways that restore the balance.

Adapted with permission of John Wiley & Sons, Inc., from Carpenter, S., & Huffman, K. (2008). *Visualizing psychology*. Hoboken, NJ: Wiley, p. 285.

Where both instinct and drive-reduction theory have problems is with the idea of voluntary decision making as part of motivation. We are capable of overriding our physiological motivational processes and doing things simply because we want to (Barrett et al., 2013). To address this shortfall, we need to add a few more concepts to our discussion of motivational factors.

Arousal Theory

Arousal theory maintains that motivation comes from a need to achieve an appropriate level of arousal (Hepach, Vaish, Müller, & Tomasello, 2019; Reeve, 2018; Wright, 2016). This theory is different from drive-reduction theory in that the motivation doesn't always arise from a need to reduce arousal back to a neutral state. While some situations, such as

hunger or thirst, can elevate our arousal to uncomfortable levels that we try to reduce (for example, by seeking food or drink), arousal theory states that we can also be motivated to elevate our arousal levels if they fall too low. Recent work from Denmark has shown this with soldiers returning from war. They report wanting more excitement than less after returning home, suggesting that the underarousal they feel when returning home may stimulate us to seek out interesting and exciting situations (Brænder, 2016; Heirene, Shearer, Roderique-Davies, & Mellalieu, 2016).

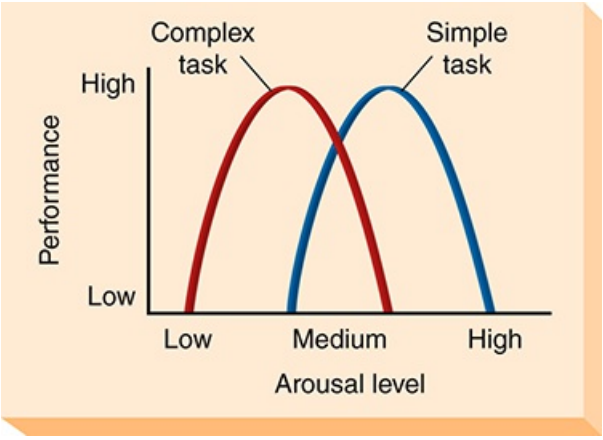

FIGURE 11.2 The Yerkes-Dodson law Our optimal performance on tasks is inversely related to our arousal level. We perform difficult tasks best when our arousal level is low to medium and simple, or boring ones best when our arousal level is medium to high.

Arousal theory explains a number of behaviours that instinct and drive-reduction theories cannot. Consider the millions of dollars earned every year by paparazzi and the tabloids. Even though a rich knowledge in the latest celebrity gossip is unlikely to enhance your reputation, and could even cause embarrassment if your interest is discovered by co-workers or others, many of us seek out gossip because we are generally curious. Curiosity often motivates us to seek out information, even if there is no other goal involved. Arousal theory would describe the behaviour of people who follow celebrity gossip as an attempt to elevate our levels of arousal and interest.

In addition to providing motivation, our arousal levels can systematically affect our performance on tasks we undertake. The **Yerkes-Dodson law** originally stated simply that arousal increases performance up to a point after which additional arousal impedes performance (1908). More recent research has expanded their initial theory to include that ideal performance on a task occurs when our arousal level is properly matched with the difficulty of the task (see photos). Task difficulty and arousal seem to be inversely related (**Figure 11.2**). That is, our performance on difficult tasks is optimal at low to medium arousal states, while our performance on easy tasks is optimal at medium to high arousal states, although this may differ between men and women (Sodhi, Luthra, & Mehta, 2016; Wu, Pan, Wang, & Chen, 2017; Wu, Pan, Zhao, & Jiang, 2019). This may be related to the fact that difficult tasks require more intense concentration that may be disrupted by highly arousing circumstances (see Psychology Around Us 11.1). Imagine, for example, that you are trying to finish writing a term paper. You may find it easier to focus on your writing if you are not highly aroused by a deadline looming only a few hours away. If, however, you

are trying to read some really boring material (something other than this book, of course), you may need to periodically raise your arousal levels with snacks, stretch breaks, and the like, to help you focus on the task.

Yerkes-Dodson law law stating that ideal performance on a task occurs when the arousal level is optimized to the difficulty level of the task.

Tom Merton/Getty Images

mediaphotos/Getty Images

The Yerkes-Dodson law in action **The baker on the left uses a knife to cut bread, while the surgeon on the right uses a sharp instrument to make an incision for surgery. According to the Yerkes-Dodson law, a high level of physical arousal will help the baker's performance but probably not the surgeon's.**

11.1 Psychology Around Us

Goalie Psychology

The Yerkes-Dodson law has obvious applications to sports. Athletes who fail to get sufficiently "psyched up" or aroused may never even get into the game. On the other hand, getting too "revved up" or over-aroused might lead to "choking." Ryan Gelinas and Krista Munroe-Chandler at the University of Windsor have examined how this and other psychological issues in motivation can impact the performance of hockey goaltenders (Gelinas & Munroe-Chandler, 2006; Hallman & Munroe-Chandler, 2009; Munroe-Chandler & Hall, 2011; Munroe-Chandler & Guerrero, 2017). They point out that each goalie (and each athlete in general) has an optimal level of arousal at which they perform their best. Some goalies need to get "psyched up" or excited to reach that

optimal level, while others need to calm down so as not to become over-aroused. High levels of arousal, especially when associated with anxiety, lead to muscle tension that can slow a goalie down. It can also narrow the goalie's visual attentional field, making it less likely that the individual will take in all the information needed to properly position him or herself in the net. The aim for goaltenders is to keep them in the "zone" of optimal arousal so that they can consistently perform at their best throughout the game.

Incentive Theory

Some behaviours are **intrinsically motivating**, which means that engaging in the behaviour is satisfying in and of itself. For some people, taking thrill-seeking rides is intrinsically motivating. Although they may never BASE jump, they occasionally like a roller coaster ride for the pleasure they get out of doing so.

intrinsic motivation engaging in a behaviour simply for the satisfaction that is part of doing it.

Other behaviours are driven by external motives, or **incentives**. Behaviour that is motivated by external incentives is known as **extrinsically motivated**. Both intrinsic and extrinsic factors influence our motivation. When it comes to performance on a particular task, the quality of the performance is driven more by intrinsic motivation. In contrast, extrinsic motivators, such as a reward, drive the amount or quantity of output on a given performance; for example, how hard and how much we work in a job setting (Cerasoli, Nicklin, & Ford, 2014). Industrial/organizational psychologists do research and consult on the important question of how to effectively motivate employees. For a historical summary of some of this research have a look at the Psychology@Work video on Work Motivation.

incentives external motives that indirectly indicate reward.

extrinsic motivation engaging in a behaviour due to the influence of factors outside ourselves.

Even when our motivation to behave in a certain way involves instinct, a drive to maintain homeostasis, or a motive to achieve an optimal level of arousal, it's clear that incentives play a major role in most human behaviour. The whole purpose of the mountain of advertising around us, for example, is to present or suggest incentives for us to use particular products. *Incentive theory* highlights the influence of external stimuli in behaviour, suggesting that external rewards, such as public acclaim or financial prizes, may contribute to the motivation of some BASE jumpers. A good deal of your own behaviour as a student is probably also motivated by external factors, such as the desire to achieve high grades, graduate on time, and have a career that is meaningful for you.

Video **PSYCHOLOGY@WORK**

Work Motivation **This video looks at the work done by industrial/organizational**

psychologists on how to effectively motivate employees. The video focuses on moving away from the carrot and stick style of motivation and instead using a more human approach.

Incentives can be either primary or secondary, and they can be rewarding or punitive.

> *Primary incentives* are rewards or punishments that are innate; we do not have to learn to either like or dislike them. Food is a primary reward, and pain is a primary punishment, for example. Most humans instinctually find food rewarding and electric shock punishing. For that reason, these stimuli are likely to influence our behaviour. There is an adaptive, or evolutionary, component to primary rewards and punishments. Typically, stimuli that increase our chances of survival and reproduction, such as food and sex, are rewarding, while those that are potentially harmful, such as any behaviour that is painful, are punishing.
>
> *Secondary incentives* are cues that are viewed as rewarding as a result of learning about their association with other events. For example, most people are motivated to work to earn money. Money, in and of itself, is not rewarding. It becomes motivating to us when we learn its association with the rewarding goods, such as food, that money can buy.

Although money is generally considered to be a strong motivator, its effects differ greatly from person to person (see photo). Why is this? Scientists attribute the different motivational power of certain cues to *incentive salience*, how noticeable or important a particular incentive is to us (Berridge, 2018). Incentives can become more salient and more motivating after they become associated with specific emotions (Berridge & Robinson, 2016; Robinson, Robinson, & Berridge, 2014).

Jorge Rios/iPhoto Inc./Toronto Ontario Canada

The big payoff **Although Canadian poker star Daniel Negreanu has consistently won big on the world poker tour, the money he wins is not, in itself, rewarding. Rather, it is what the money can buy, the prestige attached to winning so much, and the pride the big payoff instills in him.**

Consider our motivation to work hard at a job. The first time we receive a paycheque, the things we purchase with the money may lead to happiness. This association of money with happiness may, in turn, motivate us to engage in behaviours designed to improve the chance of earning even more money, such as working harder. Alternatively, if our first work experience is a very negative one that becomes associated with boredom and unhappiness, our drive to pursue happiness through hard work is less likely to expand. We may seek to avoid work altogether, or we may be motivated to look for a better and more gratifying job. Particularly for complex behaviours, such as working at a job, there can be many incentives that motivate different individuals. Some people work to avoid punishment, such as homelessness and shame, for example, while others work to receive rewards, such as money and pride (Warr, 2011).

Motivational theories that focus on incentives often take into consideration the distinction between "liking" and "wanting" (Pool et al., 2016; Berridge, 2018). "Liking" refers to our experience of reward or pleasure that happens *at the moment* we are engaging in a particular behaviour, while "wanting" refers to the anticipation of an experience that we expect will cause us pleasure. Having a pleasurable experience in the past often leads to wanting to repeat that experience again in the future. If you really like your first live concert, you might want more like it. You might even become motivated to travel to other cities, just to attend concerts.

Neuroscientists have found that overlapping, but distinct, regions of our brains are involved in liking and wanting (Kringelbach & Berridge, 2016). Pleasure, or liking, is typically associated with systems of the brain that produce *opiates*. Opiates, such as endorphins, are naturally occurring neurochemicals that contribute to our feelings of pleasure. Eating, drinking, and sex—biological motivations that we discuss later in this chapter—are all associated with a release in opiates. Other experiences, such as intense physical exercise (for example, long distance running), can also stimulate the release of brain opiates, producing a phenomenon called "runner's high" (Heijnen, Hommel, Kibele, & Colzato, 2016; Geva & Defrin, 2013). (See Psychology Around Us 11.2.)

In addition to activating the brain-opiate system, rewarding stimuli typically stimulate the release of the neurotransmitter dopamine (Kringelbach & Berridge, 2016; Berridge, 2018). As discussed in Chapter 3, dopamine is present in two major systems of the brain. One region is mostly important for movement and is affected by Parkinson's disease (Tysnes & Storstein, 2017), while the other is important for reinforcement learning. The latter system consists of dopamine neurons in a region of the midbrain, called the ventral tegmental area, which send their axons to two key areas in the front of the brain: the *nucleus accumbens* and the *prefrontal cortex* (**Figure 11.3**). How this all comes together in the brain as we engage in complex activities like running marathons is discussed later in Your Brain and Behaviour 11.1.

11.2 Psychology Around Us

Just Listen to the Music

How many of you listen to music? Do you listen to country, Top 40, rap? How does music influence your mood and motivation? In a recent study in Canada it was found that in older adolescents, listening to the music of their choice led to higher scores on measures of subjective wellbeing. Listening to music that is pleasurable and personally meaningful may make us happier (Morinville, Miranda, & Gaudreau, 2013). Music is also a powerful motivator for forming ethnocultural identities. Listening to music that fits with a person's ethnocultural identity may in turn lead to greater feelings of happiness and subjective wellbeing (Miranda et al., 2019). Music also affects our perception of food. Do you like gelati? If you do, the music you listen to may affect how much you like it. In a tasty study done by Kantono and colleagues (2016), they paired different flavours of chocolate gelati with different music. The more a person liked the music the more they liked the gelati! So if you want to truly savour your food, pair it with music that makes you happy!

Pixabay

The influence of music The goodness of gelati is made even better when enjoyed while listening to music you like.

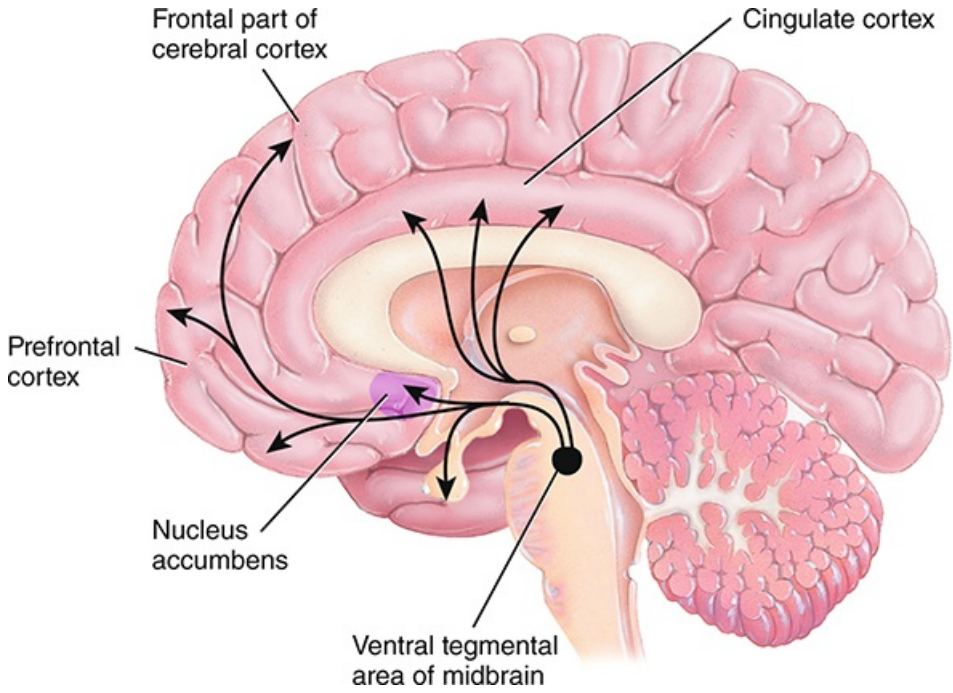

FIGURE 11.3 Reward pathways in the brain Rewarding stimuli typically trigger dopamine neurons in the ventral tegmental area of the brain. The axons of these neurons project to the nucleus accumbens and the prefrontal cortex, activating rewarding and pleasurable feelings, while others project into the cingulated cortex.

As we noted in Chapter 3, the nucleus accumbens is highly active in the experience of rewarding and pleasurable feelings (Hikida, Morita, & Macpherson, 2016). The pathways of dopamine neurons from the ventral tegmental area to the nucleus accumbens and prefrontal cortex are not only activated during the reward experience, but they appear to be critical for future behaviour directed toward that reward. In other words, the dopamine system plays a critical role in "wanting."

Although incentive theory explains how our behaviour is shaped by external stimuli, not all of our behaviour is motivated by wanting a reward or avoiding a punishment. Integrating incentive theory with other motivation theories is necessary to explain the complexity of motivation.

Multiple Motivations: Hierarchy of Needs

As we have seen, a combination of factors, including innate and learned motives, interact to drive behaviour. Psychologists have also recognized that different motives can compete with one another. For example, you may wish to lose weight but eating that ice cream sundae when it is a hot summer day is very appealing! The two objectives compete with one another (Kip & Evers, 2020). The relative strength of certain motives and their ability to supersede one another led humanist psychologist Abraham Maslow to describe motives, or needs, in terms of a *hierarchy* (Maslow, 1970; Healy, 2016). **Figure 11.4** shows Maslow's hierarchy of needs.

The most basic needs, such as the need to eat or drink, are at the bottom of the hierarchy

pyramid. Unless these needs are satisfied, we find it difficult to generate motivation to engage in other behaviours. Above the basic needs are the safety needs: the need to feel secure and stable. It's important to realize that a balance exists between the first and second tier on the pyramid. It would not make sense for us to drink tainted water when waiting would be safer. That doesn't happen often, because water is usually not a matter of life or death in Western society. But humans, as well as other animals, will often take great risks to obtain food and water if they can't be obtained in a safer setting.

After the first category of the hierarchy, which can be thought of as satisfying needs that are deficient, or needs related to safety, are the growth needs (Singh & Behera, 2016). Above safety needs is the need to feel love and to belong to a social group. This need motivates us to seek companionship in the form of friends and romantic partners. It motivates the creation of families and the formation of clubs and other social organizations. Humans vary from person to person, but as a species, we are highly social and our need for human contact is often a very strong motivator of our behaviour.

Above the need to belong socially rests the need for a feeling of self-worth. This need motivates us to achieve at school, at work, and at home (Neto, 2015). Finally, at the top of the pyramid rests the need for self-actualization. As our highest need, the need for self-actualization motivates us to live up to our potential and become the best we can be. For many people, this involves engaging in selfless, altruistic behaviour, in the form of political activism or humanitarian behaviour.

According to Maslow's theory, it will be difficult to meet the need for self-actualization unless the needs below it on the pyramid have been satisfied. Even so, many people sacrifice fulfillment of some of their basic needs to meet higher needs. Physicians who are members of Doctors without Borders, an organization that provides medical care wherever wars and disasters occur, for example, sacrifice their safety needs to fulfill their needs for self-actualization (Jacob, 2015).

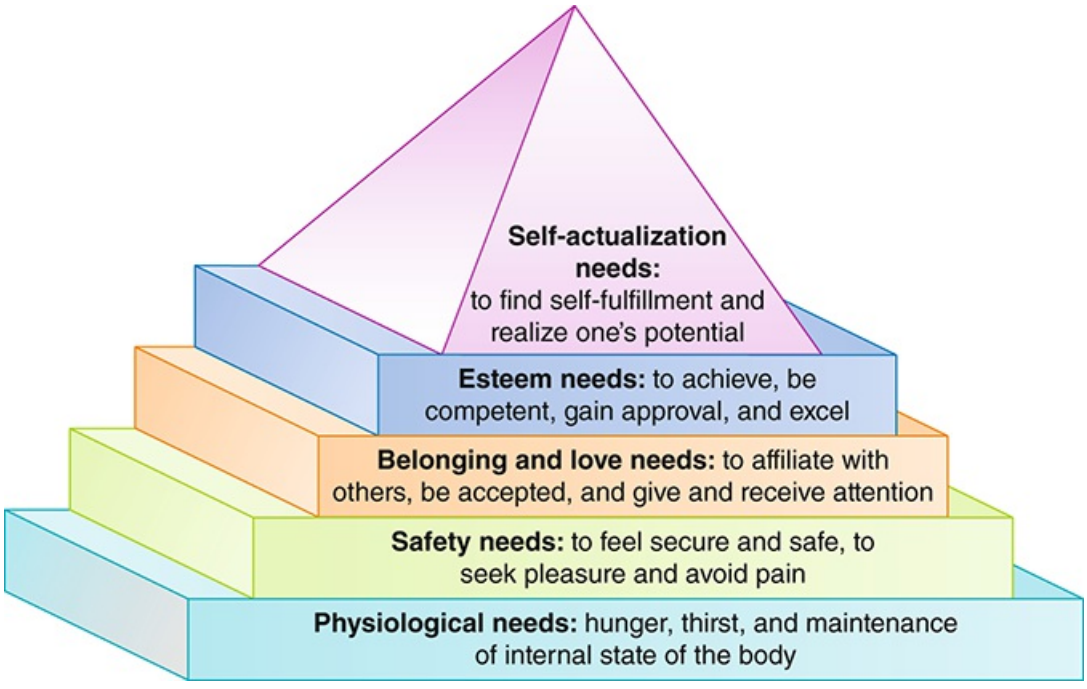

FIGURE 11.4 Maslow's hierarchy of needs **A combination of needs, both innate and learned, drive our behaviour and sometimes are in competition. Basic survival needs at the base of the pyramid are the strongest and must be satisfied first before we are motivated to achieve our higher needs.**

Toward a Unifying Theory of Motivation

The five theories you have been introduced to in this section are the classical theories of motivation. However, many others have been suggested over the years (Reeve, 2018). These theories related to various aspects of a person's development, personality, social experiences, and even culture (Baumeister, 2016; Berridge, 2018; Reeve, 2016; Dweck, 2017). To achieve the goal of a unified theory of motivation, scientists will need to understand how motivation as a psychological state has evolved in other animal species as well as ourselves. We will need to understand how motivation encapsulates our development and interacts with our environments and cultural expectations, and the limitations (or not) of our biology and nervous systems. Advances in brain imaging, statistical analysis, and experimental design will need to be combined to empirically support a unified theory of motivation (Reeve, 2016). Regardless, the theoretical field of motivation, and understanding why we do what we do, is an exciting one that we will delve into further in the next several sections of this chapter.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

1. What are some examples of instinctive motivations among humans?
2. How does drive-reduction theory differ from arousal theory?
3. What is intrinsic motivation and how does it differ from extrinsic motivation?
4. Give an example of a primary incentive and a secondary incentive.
5. What are the lowest level needs in the hierarchy of needs?

What Do You Think? • Consider one of your favourite leisure-time activities, such as reading novels, playing video games, or playing a sport. Whatever the activity, describe how each of the motivational theories discussed in this chapter would explain why you do it. Does any one theory best describe your motivation?

What can you do to improve your motivation as a student; to study more effectively, concentrate better, or set and accomplish life goals? The Learning Commons at Simon Fraser University offers a number of practical resources to stay motivated and focused while you study (http://www.lib.sfu.ca/about/branches-depts/slc/learning/motivation).

Biological Motivations: Thirst and Hunger

LEARNING OBJECTIVE 2

Summarize the factors that affect our motivation to drink and to eat.

As noted, the drives to drink and eat are biologically ingrained or instinctual. Newborn babies show interest in drinking and feeding soon after they are born (Smillie, 2013). The biological drive for these behaviours, once they begin, typically remains in place throughout our lives since we need to eat and drink to live. Neither of these behaviours, however, is simply a matter of following an instinctive pattern of neural activity. Instead, a number of other factors play a role in motivating how much, what, when, and even where we are motivated to drink and eat. In the next sections we will briefly review these biological drives for food and water, as well as look at how our psychological motivations can influence these biological drives.

Over six decades ago, Clark Hull (1943), one of the earliest scientists to study our biological motivations, proposed a model of how our bodies work to maintain homeostasis in behaviours such as drinking and eating (refer back to **Figure 11.1**). To briefly review, as we move from having enough water and food to not having enough, our physiological needs will drive our behaviours in a goal-directed way to find what we are missing. Once we find food and water, we enter the consummatory phase. Once this phase is complete, our goal-directed drive to search for food and water wanes and we return to a satiated, or homeostatic, state. While we will only discuss our motivations for water and food in this chapter, note that our body's need to maintain homeostasis is the primary biological driver, via the brain, for other biologically motivated behaviours, such as staying warm, maintaining a relatively relaxed state (Chapter 14), and sleeping (Chapter 6).

Thirst

During the course of each day, we all lose water: we sweat, urinate, and lose fluid just by breathing. Water is critical for all of our bodily functions and without it we wouldn't live for more than two, maybe three days. You may have had the experience of going without water for several hours, maybe even a day. We suspect that by the end of this time your body will have you looking for the closest tap, or convenience store, to get something to drink (see photo).

So why do we, and all other animals, have a drive to drink? Think back to Chapter 3 when we discussed the action potential. Two of the key components necessary for the generation of the action potential were the environments inside and outside of a neuron. Intracellular and extracellular spaces are fluid-filled areas that rely on having enough water present for proper functioning. The fluid that is found inside our cells is approximately 40 percent of our body weight and the fluid outside of our cells accounts for another 20 percent (Reeve, 2018). We are at least 60 percent water!

thevisualsyouneed/123 RF

Strange but true: drinking too much water can kill. In a hydration-obsessed culture, people can and do drink themselves to death.

Classical work in the area of our motivation to quench our thirst shows that two mechanisms are important for driving our need for water. The first one is based on a loss of volume, which happens when you sweat, vomit, or lose fluid from a bleed. This volumetric drive to drink is predominantly due to loss of water in extracellular spaces. Loss of water inside our cells pushes us to drink for a different reason: to maintain an appropriate ions-to-water balance inside the cell. Maintaining our intra- and extracellular fluid levels is critical for the functioning of our nervous systems and the generation of action potentials. The need for appropriate amounts of water in our bodies can even drive us to drink in anticipation of a fluid debt that can occur during vigorous exercise and activities such as ultra endurance running and cycling sports (Armstrong et al., 2015; Gizowski & Bourque, 2018).

While drinking fluids regularly is critical for the maintenance of our bodies and communication of our nervous systems, a person can drink too much! While rare, water intoxication leading to death has been reported. Marathon runners have died from drinking too much water during a race and not maintaining the proper level of ions, or salt balance, in their intra- and extracellular spaces (remember, sodium and chloride together make table salt; Siegel, 2015). Water intoxication has also been reported with ecstasy use (Salathe, Blanc, & Tagan, 2018), and sadly, a woman in California died after drinking too much water in a radio contest called “Hold Your Wee for a Wii,” where the winner who drank and held the most fluid would win a Nintendo gaming console (Ballantyne, 2007). In contrast, often as we age, the neural circuitry controlling our motivation to drink fluids in response to dehydration can become impaired. During heat waves, mortality in elderly individuals can occur due to inadequate water intake and dehydration. However, the physiological reasons for these changes with age are only beginning to be explored by scientists (Begg, 2017).

Hunger and Biological Factors

Gastrointestinal Signals

A number of stimuli contribute to hunger signals in our brain, including how full our stomachs are, the levels of nutrients circulating in our bloodstreams, and interacting with both of those signals, the activities of key parts of our brains.

As you may have experienced, an empty stomach can trigger feelings of hunger. Physicians treating obese patients take advantage of the fact that physical signals produced by stretch receptors in the stomach are important for informing the brain to stop eating. These cues, called *satiety* signals, can be activated by surgically placing a balloon in the stomach. Since the stomach space is already partially occupied by the balloon, the stretch receptors will be activated even when the person eats a relatively small meal (Williams & Steele, 2016). Another technique that works on a similar principle is the surgical placement of a band around the stomach or physically stapling the stomach so that it is much smaller (Silberhumer et al., 2011; Mans et al., 2015). By six years post-surgery however, individuals who have done a sleeve gastrectomy (band around the stomach) had been found to have regained up to 75 percent of the weight they had lost. Many individuals who have undergone these procedures lose weight at first, but then eventually gain it back, suggesting that although signals from the stomach can influence the degree to which we are motivated to eat, these signals aren't the only mediators (Lauti, Kularatna, Hill, & MacCormick, 2016).

Chemical Signals

Eating occurs as a result of a complex interplay between hunger and satiety. Considerable evidence suggests that cues related to the metabolism of food can signal hunger or satiety (Cassidy & Tong, 2017). Some of these cues are related to levels of different chemicals produced in our blood when our bodies digest food. Two of the most well-researched of these are *glucose*, also known as blood sugar, and *lipids*, the products produced when our bodies break down fats from food. There are receptors for both glucose and lipids in the brain, which can influence hunger (Besnard, 2016; Lénárd, & Karádi, 2012; Pradhan, Samson, & Sun, 2013).

The protein **leptin** is another signal that appears to be important for regulating the amount of food eaten over long periods of time. Leptin is released from our fat cells as they grow larger. When receptors in the brain sense high levels of leptin, they in turn send signals that inhibit us from eating (Schwartz, Azzara, & Heaner, 2013). Obese animals and obese humans may be insensitive to leptin. Some evidence suggests that although they have higher blood levels of leptin than normal-weight individuals, they have fewer leptin receptors in their brains, which may prevent the signal to stop eating from being generated soon enough (Zhang & Ren, 2016; Zhou & Rui, 2013). (See Indigenous Experiences 11.1.)

leptin a protein produced by fat cells that is important for regulating the amount of food eaten over long periods of time.

11.1 Indigenous Experiences

Unrelenting Hunger

Ian Mosby and his colleague Tracy Galloway at the University of Toronto (2017a) hypothesize that the malnutrition experienced by many Indigenous children in the residential school system may be a large factor in many of the increased health risks, including obesity, diabetes, and early-onset insulin resistance, observed among Indigenous peoples in Canada today. Additionally, F. J. Paul Hackett and colleagues from the University of Saskatchewan (2016) report retrospective data that suggest that the majority of Indigenous children entered the residential school system nutritionally on par with non-Indigenous children entering the Canadian school system. These findings indicate that Indigenous children experienced satisfactory nutrition in their home communities prior to entering the residential school system. It therefore seems plausible that the unrelenting hunger many survivors reported experiencing in the residential school system is responsible for many of the elevated health risks currently in the Indigenous community (Hackett, Abonyi, & Dyck, 2016).

Accounts of constant hunger were given by a large majority of survivors, who did not know one another and who attended residential schools across wide geographic areas and time periods. There is enough consistency across accounts for researchers to now claim that "the typical residential school diet was characterized by insufficient caloric intake, minimal protein and fat, severely limited access to fresh fruit and vegetables, and frequent bouts of food-borne infection" (Mosby & Galloway, 2017a, p. E1044). Here is a sample of survivor accounts:

> Doris Young, a survivor from residential schools in Saskatchewan and Manitoba, said that hunger was always present. "I was always hungry. And we stole food. I remember stealing bread. And they, the pies that, that I remember stealing were lined up on a counter, and, and they weren't for us to eat, they were for the, for the staff" (Young, 2012, p. 72).
>
> Andrew Paul, a survivor from the Aklavik Roman Catholic Residential School, recalled, "We cried to have something good to eat before we sleep. A lot of the times the food we had was rancid, full of maggots, stink" (Paul, 2012, p. 71).
>
> At times, the hunger and spoiled food were not all the children had to contend with. Bernard Catcheway recalls that at the Pine Creek school in Manitoba, "we had to eat all our food even though we didn't like it. There was a lot of times there I seen other students that threw up and they were forced to eat their own, their own vomit" (Catcheway, 2011, p. 74). This was a common punishment, with similar incidences repeated by many other survivors from many other schools.

The General Synod Archives, Anglican Church of Canada

Constant hunger **Many survivors of the residential school system report that when in school they were always hungry.**

Mosby and Galloway (2017b) describe how prolonged undernutrition leads to several long-term health risks. These risks include height stunting, which leads to heightened fat-mass accumulation, which in turn leads to obesity and other chronic illnesses. Height stunting also leads to insulin sensitivity and reduced insulin levels, increasing the risk for type 2 diabetes. Stunting also affects thyroid function, reproduction, and neurological development, and exacerbates psychological effects, such as increased stress responses, leading to increases in cortisol secretion and lowered immune function. The effects of childhood undernutrition affect not only the survivor, but their children, and their grandchildren as well through elevated body mass index, obesity, diabetes, intrauterine growth failure, and growth faltering (Mosby and Galloway, 2017a, p. E1044).

Critical Thinking Questions

What health risks are observed among Indigenous peoples that may be related to malnutrition experienced by children who lived in residential schools?

What conclusion did researchers come to with regards to food availability and nutrition for residential school survivors?

What are the intergenerational impacts of childhood undernutrition?

Brain Signals

Within the brain, the hypothalamus is a key mediator of eating. As you can see in **Figure 11.5**, specific subregions in the hypothalamus have been linked to both hunger and satiety. The **lateral hypothalamus (LH)** is important for hunger. The interaction of the LH with the nucleus accumbens, a structure important for the rewarding aspects of food, is critical

for stimulation of eating behaviours (Castro, Cole, & Berridge, 2015). A nearby brain region, the **ventromedial region of the hypothalamus (VMH)**, has been shown to play an important role in satiety. Destruction of this region leads to overeating and obesity in rats (see **Figure 11.6**). Humans with damage to this area, due to a tumour, neurosurgery, trauma, or an inflammatory disorder, can develop a condition called hypothalamic obesity, which is characterized by rapid weight gain and severe obesity (Haliloglu & Bereket, 2015). A genetic condition in humans, known as Prader-Willi syndrome, is associated with an insatiable appetite leading to obesity (see photo). This condition is believed to arise, at least in part, from dysfunction of the hypothalamus (Angulo, Butler, & Cataletto, 2015; Goldstone, Holland, Butler, & Whittington, 2012).

lateral hypothalamus (LH) a region of the hypothalamus important in signalling thirst and hunger.

ventromedial region of the hypothalamus (VMH) a region of the hypothalamus important in signalling satiety.

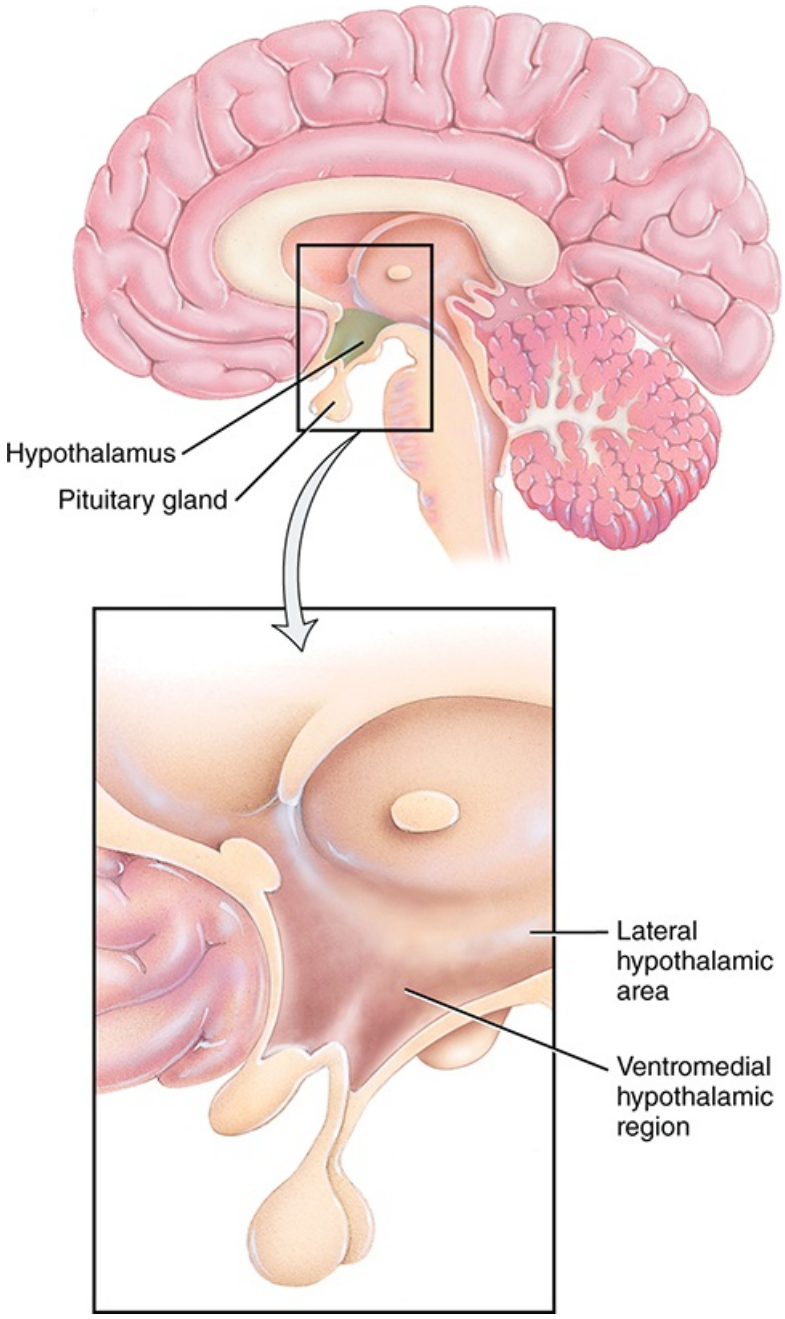

FIGURE 11.5 How the hypothalamus affects hunger This diagram shows a section of a human brain, locating the ventromedial hypothalamus (VMH) and the lateral hypothalamus (LH), which, if damaged, affects hunger.

The identification of these two brain regions as important for feeding behaviour led to the formation of the *dual-centre theory of motivation*. This idea proposes that activity in one area serves to inhibit the area that serves the opposite function. For example, an empty stomach and low blood glucose may stimulate the LH to motivate us to eat, while at the same time inhibiting satiety signals from the VMH. Once the stretch receptors are activated and blood glucose reaches a certain level, the VMH would once again become active and inhibit the LH.

Subsequent research, however, has shown that these brain regions influence eating in a more complicated way, in part through the action of a hormone called *insulin* (Briski, Mandal, Bheemanapally, & Ibrahim, 2020; Flak et al., 2020; Vogt & Bruning, 2013). The VMH appears to be important for modulating the levels of insulin in the blood. Insulin helps the body to metabolize and use glucose. Damage to the VMH can increase insulin levels. High insulin levels, in turn, cause our fat cells to store more glucose and grow. So, it is not just a matter of the VMH failing to provide these animals with a satiety signal; they are actually short on blood sugar, or glucose. Because they store energy from glucose as fat more rapidly than undamaged animals, the signals of satiety, such as an increase in blood-glucose level, don't occur. As a result, the animals continue eating.

As we have stressed throughout this book, however, it's important to remember that no single area of the brain acts alone, especially in a complex behaviour such as eating. Along with the hypothalamus, several additional brain regions participate in eating. Our ability to taste food certainly plays a role in eating, for example. As described in Chapter 5, taste information is processed in the regions of the prefrontal cortex. Disgust cues related to the presentation of unpalatable food involve the insular cortex, a region situated close to the prefrontal cortex (Corradi-Dell'Acqua, Tusche, Vuilleumier, & Singer, 2016).

Courtesy Philip Teitelbaum

FIGURE 11.6 The VMH and obesity The rat on the left had its ventromedial hypothalamus destroyed, which led to overeating and a dramatic increase in its body weight compared to the normal-weight rat in the picture.

Not only are many areas of the brain involved in eating, but the brain circuitry involved in our eating behaviour is also active in a variety of motivational situations. Pathways important for general reward, punishment, and disgust under other circumstances interact with brain regions that specifically process visual, olfactory, and gustatory information to modulate eating. For example, the same part of our brain that is active when taking an addictive drug—the dopaminergic pathway from the ventral tegmental area to the nucleus accumbens—is the same pathway that is activated when we crave and indulge in the foods we love, such as chocolate, chips, and pasta (Volkow, Wise, & Baler, 2017).

Hunger and Social Factors

Food is strongly associated with social interactions. Studies have shown that people eat considerably more when they are in a social setting, particularly when it is a relatively large gathering, compared to when eating alone or eating as part of a business meeting (Herman, 2015). Interestingly, this motivation to eat when in a social setting can be used to support elderly individuals to maintain their motivation to eat. A program in Tasmania in Australia, Eating with Friends, has found that providing social eating environments for seniors led to a greater interest in food and in maintaining the social connections created while eating (Boyer, Orpin, & King, 2016).

Eye - CNImaging/Newscom

Uncontrollable appetite **Prader-Willi Syndrome causes unstoppable appetite.**

Some researchers have also suggested that we each have an individual **body weight set point**. Researchers have long recognized that as adults, our weights tend to stabilize near a certain general level. We may fluctuate in a small range around that weight, but we often return to the original set point, even after major deviations from it (Geary, 2020; Münzberg Qualls-Creekmore, Morrison, & Berthoud, 2016). This is particularly evident when people diet. A reduction in body weight is often followed by a rebound back toward the original weight, which is why so many dieters fail to achieve lasting weight loss. This isn't always the case, however. Some people do undergo dramatic weight changes in one direction or another and maintain their new weights for a considerable period of time. People who maintain a lower body weight typically make permanent changes in their eating and/or their exercise habits and persistently monitor their weight (The Look AHEAD Research Group, 2014).

> **body weight set point** a weight that individuals typically return to even after dieting or overeating.

Other research suggests, however, that body weight set point is not the only factor at play in determining how much we eat. From an evolutionary point of view, our ancestors may not have been concerned with overeating but with the lack of consistent food.

Consequently, when food was available, our ancestors ate a lot to build up fat stores in case the next meals were some time away (see photo). Stopping eating to maintain a set point weight would not have been adaptive (Speakman, 2018).

Hunger and Eating Disorders

Our motivation to eat is very complex, affected not only by intricate biological processes, but also by psychological, social, and cultural influences. As with any complex system, we face the potential for problems in our eating behaviour. Two of the most common problems include obesity, often related to too much eating, and eating disorders, which often involve eating too little.

Alex Segre/Alamy Stock Photo

Food and eating behaviour **The availability of food is an important additional factor in eating behaviour. Many individuals in societies such as much of North America, where food is plentiful, find their weights steadily creeping up over the years (Goryakin & Suhrcke, 2014).**

Obesity

Obesity, a condition of extreme overweight, is determined on the basis of a weight-to-height ratio, called the **body mass index (BMI)**. Adults with a BMI of 30 or higher are considered *obese*, and those with BMIs between 25 and 30 are categorized as *overweight* (Health Canada, 2015). The current global health crisis of increasing rates of obesity also affects Canadians. The Canadian Community Health Survey (Statistics Canada, 2019) shows that in individuals over 18 years of age, 26.8 percent are overweight or obese. This varies

between the provinces, with British Columbia having the lowest percentage (23.1) and Newfoundland and Labrador having the highest (40.2 percent). Interestingly, individuals with higher levels of education are less likely to be obese. While this is a correlational, not causal, finding, it is an interesting social factor that may be indicative of differences in our intellectual understanding of the nutritional value of food and food access (**Navaneelan** & Janz, 2014; Rush & Yan, 2017). For example, food environments called "food swamps"—geographic areas where healthy food options are scarce and there is a high density of businesses selling junk and fast food—are areas with high levels of obesity (Cooksey-Stowers, Schawrtz, & Brownell, 2017). Being overweight or obese is associated with a variety of health problems, most notably diabetes and heart disease (Carbone, Lavie, & Arena, 2017). In addition to the physical risks they face, obese people are also more likely than those of normal weight to suffer from mood disorders, such as depression and anxiety. Two recent meta-analyses show that the comorbidity rates of obesity, with diabetes and heart disease, are higher in women and non-Western individuals (Mannan, Mamun, Doi, & Clavarino, 2016; Quek, Tam, Zhang, & Ho, 2017).

obesity overweight characterized as a body mass index of over 30.

body mass index (BMI) weight-to-height ratio.

Obese people are also often the victims of discrimination. A study found that people describe obese individuals as less attractive than thinner people, and ascribe a number of other unfavourable characteristics to people who are obese (Puhl & Heuer, 2010). Although overweight people are often considered as "friendly" and "happy," they are also judged more often as "lazy," "stupid," and "incompetent" than are people of normal weight (Ringel & Ditto, 2019). Obese individuals are also more often turned down for jobs (Flint et al., 2016; Spahlholz et al., 2016). (See photo.)

Why is obesity becoming so common? One answer to this question may be found by considering the evolutionary perspective. Early people evolved under conditions of unpredictable food availability. At times when food was plentiful, after a successful hunt or during a time when weather conditions led to an abundance of edible plants, it was surely advantageous to overeat in preparation for subsequent food deprivation. Overeating led to fat storage that increased the chances of survival throughout periods when food was scarce. In many of today's developed cultures, especially in North America, where inexpensive high-calorie food is readily available, this built-in adaptive mechanism is being activated in a chronic and maladaptive way. Intermittent overeating followed by periods of fasting has been replaced by chronic, continuous overeating.

José Manuel Gelpi Díaz/Alamy Stock Photo

Overweight and stigmatized **Relative to non-obese people, overweight individuals are stigmatized by being viewed negatively and experience lower hiring rates when applying for jobs for which they are qualified.**

The problem of overeating has intensified over the past few decades, as the food and restaurant industries have increased the size of portions, and prepared foods have become a mainstay of the North American diet. Consider the fact that in 1955, when McDonald's restaurants opened, a regular size adult's soft drink was 199 ml (7 ounces). In the new millennium, a child-sized serving of soft drink is 355 ml, and adults can choose from 473-, 621-, or 946-ml beverages (Young & Nestle, 2007). Burger King offers a Triple Whopper® sandwich that is 1,160 calories, almost half the recommended daily calorie allotment for an average adult male (Burger King, 2020).

Consumer behaviour research strongly suggests that North Americans appreciate large-size portions because they appear to be a good value (Rolls, 2014). However, it's very difficult to regulate the amount of food you ingest when the portions are so much larger than those recommended for maintaining a healthy weight. The massive oversizing of portions so common today has, for many of us, led to an increase in energy intake, as measured in calories, without a corresponding change in energy expenditure. As a result,

people gain weight.

Once people become accustomed to ingesting very large amounts of food, scaling back to sensible-sized portions can feel like deprivation. Many nutritionists often suggest that dieters eat their food from smaller plates to avoid feeling that the reduced portions are meager. This trick alone is typically not sufficient to support a substantial weight loss, however.

In fact, billions of dollars are spent every year on dieting programs and products that are designed to help overweight individuals lose weight and keep it off (Redmond, Kahan, & Cheskin, 2014). However, diet programs are often unsuccessful for long-term weight change (Gudzune et al., 2015; Lemstra et al., 2016). Some approaches to obesity prevention may be suggested by identifying the risk factors for developing obesity. Why are some people more prone to obesity than others? The answer seems to involve multiple factors.

One substantial contributor to obesity is genes. Adoption and twin studies have shown that a good deal of the variation in obesity can be attributed to genetics. For example, adopted individuals tend to have the body mass indexes that more closely resemble the BMIs of their biological parents than those of their adoptive parents (Classen & Thompson, 2016). Moreover, identical twins separated at birth are as similar in body weight as those who were raised together; these classical data were recently confirmed in a study in China (Price & Gottesman, 1991; Zhou et al., 2015). This strongly suggests that genetics play a major role in determining obesity. Scientists do not completely understand exactly how our genes might predispose us to become obese. Some possibilities include inheriting a larger than normal number of fat cells, a lower metabolic rate (the speed at which we break down and burn the calories in food), or, as we saw earlier in the chapter, an abnormal leptin gene (van der Klaauw & Farooqi, 2015).

Genetics alone cannot explain the rise in obesity over the past few decades in this country, however. Genes may predispose people to become overweight, but the environment must be conducive to overeating in order for them to realize this potential (see photo). As we have seen, social and cultural factors contribute to our eating behaviour. The social aspect of overeating is evident in recent findings that humans are much more likely to gain weight if they have an overweight friend, even if that person lives far away and the number of shared meals is minimal (Oliveira, Rostila, de Leon, & Lopes, 2013). One explanation for this correlation is that having overweight friends produces less resistance to gaining weight, perhaps because weight gain becomes associated with the positive stimulus of friendship. Obesity (especially among women) is also much more common among members of lower socio-economic groups than in higher socio-economic groups (Jaacks et al., 2019). Researchers have suggested that this may be the result of less education about nutrition, fewer healthy food choices (the cost and availability of healthy food), and less social pressure to be thin. For example, a recent study in Chile showed that for women, body size ideal varies with socio-economic status. Thinness is more valued in women from higher socio-economic status (Robinovich et al., 2018). Finally, we must consider the role played by human psychology in weight management. Self-regulation of things like food intake (type and amount) is complex and subject to stress, fatigue, time of day, distractions, and even frequency of use (Karasu, 2012). The internal nature of self-regulation helps to explain why programs (like the television program *The Biggest Loser*) do not typically produce sustained weight loss; they backfire. Once the show is over and the external

incentives stop, so does the motivation (Grant, 2012). As bleak as this sounds it suggests that if we can get support for our own self-regulation efforts, sustained weight loss is possible. (A few good places to start are listed in the references list: NIDDK, 2012; Mayo Clinic, 2016; and Dumain, 2011.)

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Genes or environment? Research clearly suggests that obesity is related to genes, but there is also evidence that the eating habits of parents and other family members can play a major role in the development of this problem.

Although obesity can significantly reduce quality of life, people can be overweight for decades before the negative health effects become evident. In contrast, eating disorders on the other end of the spectrum, those that involve eating too little, can lead rather abruptly to emergency situations, and even death.

Anorexia Nervosa, Bulimia Nervosa, and Binge Eating Disorder

Anorexia nervosa is a condition in which individuals are preoccupied with the notion that they are fat or will become fat, and have a distorted image of being overweight (when they are not). To combat these thoughts, people with anorexia engage in extreme dieting, often eating fewer than 500 calories per day (Zipfel et al., 2015). The restricted eating associated with anorexia generally leads to extreme weight loss, which can be very dangerous. People who lose too much weight are at greater risk for illnesses and imbalances in their blood chemistry. In as many as 10 percent of cases, anorexic weight loss leads to death (Arcelus, Mitchell, Wales, & Nielsen, 2011).

> **anorexia nervosa** eating disorder in which individuals under-eat and have a distorted body image of being overweight.

It's important to realize that there are major differences between people who diet, even

those who do so continuously, and those with anorexia. People with anorexia have a distorted body image. Even when they are dangerously thin, they still think of themselves as fat and often cannot be convinced to increase their calorie intake. They may use laxatives or exercise to burn off the small number of calories they take in. For females, this lack of nutrition can cause their periods to stop or to not start with maturity.

Anorexia can begin as early as puberty (Timko, DeFilipp, & Dakanalis, 2019). Statistics suggest that about 1 in 300 young women in Canada have anorexia (Samokhvalov et al., 2012). It is much more common in females than males, although recent years have seen an increase in the number of males diagnosed with the condition (Mohler-Kuo et al., 2016).

The causes of anorexia are complex, but it is most common in cultures where food is prevalent and social pressure exists for people to be thin (Lavis, 2016). Similarly, many theorists have noted, with alarm, that today's media and fashion industry glamorize dangerously thin models (see photo). Anorexia often coexists with other anxiety disorders, such as obsessive-compulsive disorder (Cederlöf et al., 2015), which we discussed in Chapter 9, suggesting that anorexia is just one of several possible outlets for a more general psychological disturbance. Recent neuroscience research examining genetic changes in individuals with anorexia nervosa and OCD shows that there is a shared genetic risk between these disorders (Yilmaz et al., 2018). Changes in the brain have been found in the basal ganglia, a group of structures important for habit formation and reward (Leppanen et al., 2020). The circuit between the thalamus and frontal cortex is also altered and individuals with anorexia often have cognitive challenges in several areas, including performance on tasks such as the Stroop Task (see Chapter 5; Biezonski, Cha, Steinglass, & Posner, 2016).

REUTERS / David Gray - stock.adobe.com

Dangerous trend After the death of Brazilian model Ana Carolina Reston in 2006, the fashion industry has been criticized for using increasingly thin models, like this one. Reston was only 21 and weighed just 88 pounds (about 40 kg) when she died of complications from anorexia nervosa.

Kristen von Ranson at the Eating Disorders Clinic in the Psychology Department at the University of Calgary studies the difficulty of treating anorexia and the importance of developing and applying evidenced-based treatment models (von Ranson, Wallace, & Stevenson, 2013). Treatment of anorexia may involve hospitalization if extreme weight loss occurs, where patients receive nutritional counselling to help restore a healthy weight. In addition, cognitive-behavioural therapy is used to attempt to help patients develop a healthier body image (Dalle Grave et al., 2016). Adolescents with anorexia may also benefit from family therapy (Jewell et al., 2016).

Bulimia nervosa is a disorder in which individuals consume excessive calories and then go to extremes to prevent those calories from contributing to weight gain. People with bulimia typically rid themselves of excess food by inducing vomiting or diarrhea or by engaging in intensive exercise (Mehler & Rylander, 2015). This cycle of bingeing followed by purging defines bulimia. Although people with anorexia often engage in bulimic behaviour to prevent weight gain, most people with bulimia do not appear to be underweight; some are even overweight (Probst et al., 2004). Like anorexia, bulimia is more common among females than males. Studies suggest that about 1 out of 100 young women in Canada have bulimia (Samokhvalov et al., 2012).

bulimia nervosa eating disorder in which individuals binge and then engage in purging-type behaviour.

The causes of bulimia are difficult to pinpoint. Like anorexia, bulimia is associated with other psychological disturbances, including OCD (Keski-Rahkonen & Mustelin, 2016). A significant number of people with bulimia also engage in other damaging behaviours, such as non-suicidal self-injury (cutting) (Cucchi et al., 2016).

Compared to anorexia, bulimia is somewhat less likely to be fatal (Samokhvalov et al., 2012). However, it can produce unwanted medical and dental problems, such as constipation from overuse of laxatives and tooth decay from excessive vomiting (Westmoreland, Krantz, & Mehler, 2016). The psychological effects of bulimic behaviour can be even more damaging than the physical ones. Because people with bulimia are generally ashamed of their binge–purge behaviours, they generally carry out these behaviours privately and make attempts to hide the evidence and keep their condition a secret. This secrecy, as well as the syndrome itself, often contributes to anxiety and depression (Hail & Le Grange, 2018; Levinson et al., 2017).

Treatment of bulimia requires that patients admit that the problem exists and talk openly about it. Effective treatments for bulimia include behavioural modification, in which healthier eating behaviours are rewarded, and cognitive therapy, which attempts to help people with bulimia develop healthier views of themselves and their eating patterns (Onslow, Woodward, Hoefkens, & Waddigton, 2016). Antidepressant and other drug treatments have also been found to be effective, particularly when combined with behavioural or cognitive therapy (Grilo, Reas, & Mitchell, 2016).

Binge eating disorder occurs when an individual repeatedly and compulsively, over months and years, consumes excessively large amounts of food during short periods of time. This is not the same as overeating, which many of us do on occasion. Binge eating is commonly associated with psychological distress, a sense of loss of control over what is being eaten, and the inability to stop eating. This disorder is more common in women than in men, and in individuals who are already obese. Typically, eating is done very quickly, often when someone is already full. It is also typically done alone due to feelings of embarrassment about the amount of food being consumed, and is accompanied by feelings of self-loathing (Monell, Clinton, & Birgegård, 2020). Negative emotional states often lead to binge eating, and a sense of shame about this eating disorder is common (Duarte & Pinto-Gouveia, 2017; Leehr et al., 2015).

binge eating disorder out-of-control eating of an unusually large amount of food in a single event, often multiple times per week, over several months or years.

Recent neuroimaging studies show lower prefrontal cortex activity and less inhibitory control in the circuitry between the basal ganglia and cortex, a circuit that may be involved in controlling impulsive/compulsive behaviours in some individuals who binge eat. While these findings suggest that binge eating is related to changes in brain function, more research is needed to confirm these findings (Donnelly et al., 2018; Kessler, Hutson, Herman, & Potenza, 2016; Lavagnino et al., 2016). Typical treatments for binge eating

disorder are antidepressants and cognitive behavioural therapy, which help with the emotional aspects of the disorder, but weight loss does not often accompany these treatments (Peat et al., 2017).

Young people with concerns about eating disorders (involving themselves or a friend or relative) can get help in several ways. First, if you or your friend or relative is a student at a college or university, the student counselling or health and wellness centre on campus will be able to arrange contact with a counsellor or therapist, or arrange for a referral to a local counselling or resource centre. A general practitioner (family doctor) will also be able to arrange a referral to someone who can talk about eating disorders and offer services. Finally, you can find out about local eating disorder resources through the Canadian National Eating Disorder Information Centre (www.nedic.ca). If you are concerned about someone in your life who you think might be struggling with an eating disorder, it is worth seeking support from professionals.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

6. Describe three main categories of biological hunger signals.

7. What non-biological factors affect our eating behaviour?

8. What is obesity and what factors can contribute to it?

9. What are the characteristics of binge eating disorder, anorexia nervosa and bulimia nervosa?

What Do You Think? • As a public-health effort to combat obesity, some jurisdictions are considering regulations that would require restaurants to provide calorie and other nutritional information about food on their menus. What are some potential advantages and disadvantages of providing this information to diners?

Biological Motivations: Mate Choice and Sex

LEARNING OBJECTIVE 3

Describe factors that affect our motivation to choose a mate and to have sex.

Another basic biological motivation is finding a mate and having sex. From an evolutionary perspective, engaging in sexual behaviour is highly adaptive; the continuation of the species depends on it (as we explain in the next section on finding a mate). However, most sexual behaviour does not occur with the goal of procreating in mind. Actually, the opposite seems to be true. Humans often engage in sexual behaviour while taking steps to avoid conception. Humans, as well as other animals, seek out and engage in sexual behaviour because it is a primary drive—it's pleasurable and rewarding. We will delve into the more

complicated aspects of sex in the latter half of this learning objective.

Choosing a Mate

All species need to reproduce to survive. The majority of animal species have certain qualities that they find desirable in a mate; quite simply, members of a species that display those qualities have a better chance of mating and reproducing. This is true for humans as well. Even if you can't fathom the thought of being a parent right now, for many of you, chances are good that at some point you will want to have children. Whether you realize it or not, the person you choose to have children with has been or will be selected based in part on your perception of his or her fitness to reproduce. Peacocks provide an excellent example of how evolution has led to desirable qualities for mating. Female peahens prefer mates with elaborate tails—the more elaborate the better! Over time, this preference has led to a male phenotype (observable characteristic) with an elaborate tail; that is, males with elaborate tails are more frequently chosen as mates by females, and therefore the genes necessary for the production of more elaborate tails have been passed on. What females prefer about a male peacock's tail feathers is still being studied, but Canadian researchers Roslyn Dakin and Robert Montgomerie (2011) have shown that one factor that seems to matter to peahens is the absolute number of "eyes" the tail has. Their data indicate that if a peacock has only 120 to 130 eyespots on his tail, his chances of mating are low; but having more than 138 eyespots makes a male a definite contender as a future mate. Thus, the peacock's tail is thought to have evolved the elaborate fan that it currently sports because of females choosing males with bigger and more elaborately designed tails (see photo).

Shawn Hempel/Adobe Stock Photos

Evolution at work **A peacock's elaborate tail is a consequence of evolution in action. Peahens prefer mating with peacocks that have many eyes on their tails, which has led to the large, ornate fan you see here.**

Humans don't have elaborate tails, but clearly there are many physical differences between men and women. Think about what you would like in a potential partner. If a male

reproductive partner is what you are looking for (assuming you identify as a female), chances are you would prefer someone taller with broad shoulders and narrower hips. If you are looking for a female reproductive partner, a small waist and curvy hips is likely your preference (Murnen et al., 2015). Scientists have determined that females prefer males with a hip to waist ratio of 0.9, and males prefer females with a hip to waist ratio of 0.7–0.8 (Singh, 1994, 1995); these preferences are not culturally specific. Interestingly, in one meta-analysis, it was concluded that what a woman prefers in an opposite sex partner can be influenced by her hormonal state. When ovulating, a freely cycling woman not using birth control (which will change your hormonal state at ovulation) has a higher preference for men as just described. At times when women are not ovulating, they may show less of a preference for tall, muscular, and broad-shouldered men. Additionally, what females state they prefer when it comes to the long-term attractiveness of a partner is different from what they find attractive in a short-term partner. Women tend to look for physical "fitness" in short-term partners and kindness, willingness to help raise offspring, and resource provision in long-term partners (Gildersleeve, Haselton, & Fales, 2014).

Hip-to-waist ratio is only one example of the physical qualities that we rate as attractive—facial symmetry (Conroy-Beam & Buss, 2016), the perceived masculinity and femininity of a face (Glassenberg et al., 2010), symmetry in movement (Brown et al., 2005), voice pitch (Apicella, Feinberg, & Marlowe, 2007; Feinberg et al., 2006), and body odour (Lübke & Pause, 2015) have also been shown to play a role in what we perceive as attractive in a potential mate. Why have these preferences evolved? We don't know for sure, but what has been hypothesized is that these differences give us clues about the physiological and reproductive health of a potential mate. For instance, some argue that these traits tell us about an individual's development (Shackelford & Larsen, 1997), current hormonal status (Miller, Tybur, & Jordan, 2007), or immune system function (Roberts et al., 2005).

While physical attributes and genetic inheritance (Tooby and Cosmides, 1992) have their place in shaping our evolutionary history of mate selection, there are those who argue that physical attributes are not the only aspects of mate selection we pay attention to. In the book *The Mating Mind* (2000), Geoffrey Miller suggests that our creativity and how intelligence is valued are also shaped by evolutionary processes and influence mate choice. Other scientists, such as cultural evolutionists, argue that many of the traits we find desirable in a mate are based on a cultural process of passing down specific behaviours from one generation to the next, or by passing behavioural traits across cultures (Brown & Richerson, 2013). For example, imagine you are in your twenties and end up shipwrecked, hungry, and alone on an island in the middle of the Pacific Ocean. You may notice that the individuals on the island avoid eating certain plants and you decide that it is likely best for you to avoid these plants as well. You may find out later that these plants are harmless but it is also possible you may not live to tell the tale because they are filled with a neurotoxin that paralyzes your body. The cultural transmission of "don't eat certain plants" knowledge may save your life so you can go on to reproduce. Many scientists argue that cultural influences on our behaviours and knowledge can also influence our long-term evolutionary fitness (Roos, Gelfand, Nau, & Lun, 2015).

It will take further scientific research to determine more fully how our mate preferences have evolved. For now what we can say is that, just like peacocks, humans seem to be motivated to choose reproductive mates with certain physical and/or behavioural traits.

We partly choose mates based on physiology and behaviour, but we also may be motivated to choose them based on the resources that the individual might be able to contribute to caring for our offspring. Resources are essential due to the length of time that it takes to get a human child to reproductive maturity. Beginning in the 1990s, David Buss established that across cultures, males prefer younger women who have a greater likelihood of being able to become pregnant and carry to term viable offspring. Females, in contrast, prefer males with resources—in the case of humans, the idea of "resources" often equates to money (Botwin, Buss, & Shackelford, 1997; Buss, 2015, 2009). Reproductive females put a great deal of their biological resources into carrying a child to term and then caring for it after birth. Males, by contrast, can fertilize and "run." Thus, for males, physical resources in potential female mates may not be as important as physiological characteristics such as age.

Sex: Psychological and Social Factors

Although there is a basic biological instinct to engage in sexual activity to reproduce, sexual motivation is also strongly governed by social cues. In some species of animals, only select members of the social group reproduce. Among honeybees, for example, only the queen bee of each hive reproduces, while the other bees work to maintain the living environment (Korb, 2010). In other classic work it's been shown that in marmoset monkeys, dominant females in a social group procreate, and the other females help to raise the dominants' babies. Subordinate females must wait until a change occurs in the social order (perhaps a dominant will get old and sick and lose her rank) before they can reproduce (Wahab, Drummer, & Behr, 2015).

Among humans, cultural factors play an important role in determining our choice and number of sexual partners, our range of sexual practices, and the age at which sexual activity typically begins. For instance, some societies, such as certain African Zulu cultures practise polygamy, an arrangement in which men have multiple wives. Other societies, such as the Nayar of South West India, practise polyandry, an arrangement in which women have multiple male sexual partners (Ngema, 2016).

Societies also vary in the sexual practices that are considered taboo or unacceptable. For example, in Canada, young people have a range of protections that are in force up to their eighteenth birthday. It is not legally possible for anyone under 16 to provide consent for sexual activity if their partner is five years older than them. As such, any sexual involvement with younger teens by older individuals is considered non-consensual and an occurrence of sexual assault. The age of consent is higher (18 years of age) if exploitation (prostitution, pornography, etc.) is involved. In contrast, in some Middle Eastern countries, the earliest age of marriage (and its consummation) is 9 years old (Admon, 2009).

Some sexual taboos seem to be almost universal, however, suggesting that they may be rooted in human evolution. One example of this is the incest taboo. In most cultures, incest, or having sex with close relatives, is forbidden (with rare exceptions, such as ancient Egypt, when it was deemed necessary to preserve a royal bloodline). It is also illegal for siblings to marry in most countries throughout the world. In one case in Germany, for example, a biological brother and sister who were brought up separately, then met and fell in love as young adults, were sentenced to prison after marrying (Connolly, 2007; Sharaby, 2019).

Jonathan REUTERS/Todd Korol/Newscom

Of national concern Winston Blackmore is the religious leader of the controversial polygamous community of Bountiful, located near Creston, B.C., and was charged with polygamy in 2014.

Although norms vary from culture to culture, as we have seen, all cultures do approve certain sexual practices while condemning others (see photo). Within nations, many religious, ethnic, and other subcultural groups also influence the sexual behaviour of their members. In many societies, sex is not acceptable unless the couple's relationship is considered legitimate, often as a result of marriage (Cavendish, 2010). In North America, the sexual revolution of the 1960s and 1970s loosened many social restrictions on premarital sex. Today, about 17 percent of Canadian couples living together are unmarried and are more likely to cohabitate rather than get married, especially those with higher levels of education (Statistics Canada, 2012; Wright, 2019). The number of young adults with multiple sexual partners has also increased. By the time most individuals reach their early 20s, they have had three to four sexual partners (Rossi, Poulin, & Boislard, 2016). Some sexual behaviours, such as homosexual relationships, are becoming more widely accepted. Canada has a national law allowing for marriage among same-sex couples, and increasingly strong enforcement of laws against discrimination based on sexual orientation (Matheson, 2015; Johnson & Tremblay, 2016).

Changes in societal views of sex grew, in part, from psychology research on sexual behaviour. One of the most influential sex researchers was biologist Alfred Kinsey. Early in his career, as a junior faculty member at Indiana University, Kinsey was assigned to teach a course in basic sex practices along with a team of all male instructors (Moore, Davidson, & Fisher, 2010). Realizing that many of his college students were uneducated about basic sexual practices, Kinsey switched his field of study in the 1940s from insect behaviour to human sexual behaviour (Drucker, 2014). He then undertook a massive project, interviewing thousands of people to collect data on the sexual practices of ordinary Americans. Kinsey's work was widely publicized and led to the realization that many "normal" Americans engaged in sexual behaviour that was not considered to be

conventional at the time, including oral sex, anal sex, and having multiple partners (Kinsey, Pomeroy, & Martin, 1948; Kinsey, Pomeroy, Martin, & Gebhard, 1953; Drucker, 2014). Kinsey's work helped to lessen taboos about discussing these sexual practices, because people realized they were not uncommon.

ArtistAllen/Getty Images

The body during sex **During sex the body goes through physiological changes and sexual responses.**

Sex: Physiological and Neurological Factors

Sex: What Happens in the Body

During the 1950s and 1960s, researchers William Masters and Virginia Johnson brought the study of sexual behaviour into the laboratory. Masters and Johnson recorded some of the first physiological data in humans during sex (see photo). They studied the sexual responses of both men and women and described four general, phases of the human sexual response, as shown in **Figure 11.7** (Masters & Johnson, 1966).

Excitement This is the beginning of arousal and it can last up to several hours. Heart rate quickens, though not constantly over a long period of time.

Plateau At this phase, breathing and pulse rates increase. Muscles tense and a flush may appear across the chest.

Orgasm Muscle tension and blood pressure reach a peak. This is quickly followed by climax, which is a series of muscle contractions (the intensity varies, particularly among women).

Resolution Muscles relax and heart rate returns to normal. While men have a refractory period after an orgasm, during which they cannot ejaculate, women may have additional orgasms.

In the 1970s, sex therapist Helen Kaplan incorporated an additional element to the beginning of the sexual response cycle. Kaplan believed that *desire*—basically, whether or

not you're "in the mood"—was a necessary condition to motivate an individual to become sexually excited (Kaplan, 1977). The research of Masters and Johnson and those that followed, such as Kaplan, was particularly influential for North American society, because it encouraged women to enjoy sex, which was previously considered to be inappropriate (Weiss, 2000). Masters and Johnson's research also dispelled myths about aging and sexual behaviour. Prior to their research, the conventional view was that sexual behaviour was the realm of young to middle-aged adults, and that after a certain age, sexual behaviour was minimal, if not physically impossible. As a result of Masters and Johnson's research, as well as others that followed, the current view is that sexual behaviour can continue throughout old age, providing a person remains physically healthy and has a willing partner (Forbes, Eaton, & Krueger, 2017; Sinković & Towler, 2019). (See photo.)

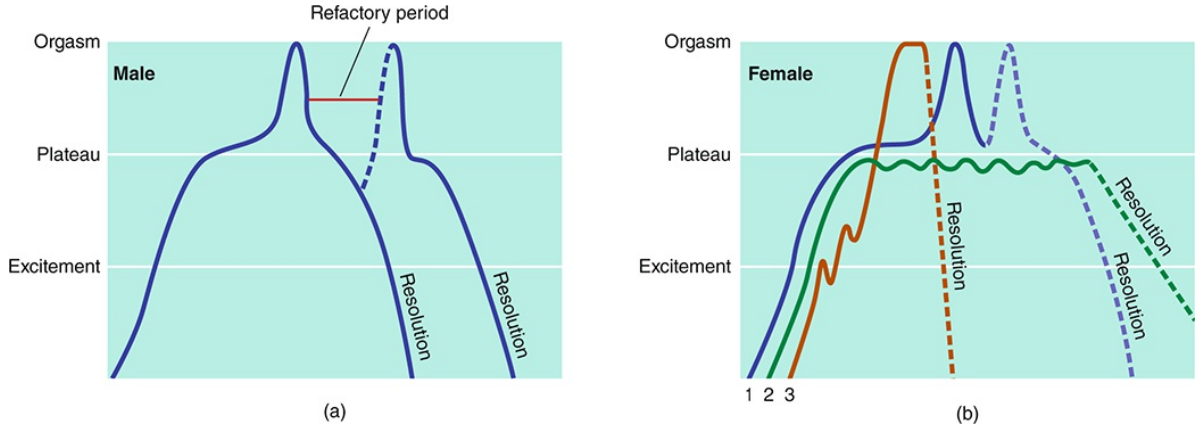


FIGURE 11.7 Human sexual responses **Masters and Johnson identified four phases in sexual response. Part (a) illustrates the typical pattern in males. Women experience greater variability in their sexual response. Part (b) shows three female patterns. Reprinted with permission from Masters, W. H., & Johnson V. E. (1966). *Human sexual response*. Boston: Little, Brown, p. 5. Copyright © 1966 by the Masters and Johnson Institute.**

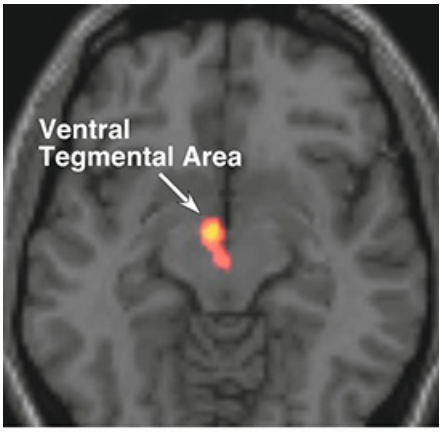
hfng/Getty Images

Sex at any age **Sexual activity can continue into old age as long as partners are willing.**

Although the work of the early sex researchers was highly controversial at the time (Cochran, Mosteller, & Tukey, 1953), the publicity these researchers received had the lasting effects of increasing awareness of sexual behaviour and altering societal standards of what is considered normal (Gagnon, 1975). This early psychological research on sexuality emphasized that sexual behaviour is a wholesome and healthy activity, and that idea represented a major change in thinking compared to earlier, more restrictive attitudes. It also encouraged more extensive research into our typical physiological sexual responses, including what happens in the brain during sex, thus broadening the field of acceptable research.

Sex: What Happens in the Brain

Reproductive hormones are clearly important factors in modulating sexual behaviour (Pfaff & Joels, 2016). In males, the testes and adrenal glands produce male sex hormones collectively referred to as *androgens*. In females, the ovaries produce the female sex hormones (*estrogen* and *progesterone*). Even though androgens are referred to as male sex hormones, they are produced by the adrenal glands of females too. Like all other hormones, these molecules are released in the blood stream and travel throughout the body. In men, blood levels of androgens, particularly testosterone, are linked positively to sex drive (Jordan, fomberger, Stolpman, & Muller, 2011). On average, sex drive in males declines with advancing age as testosterone levels drop, although as we have seen, aging does not preclude sexual interest and activity (Lindau & Gavrilova, 2010; O'Connor et al., 2011). In women, the story appears to be a bit more complicated—estrogen levels are important for the physiological aspects of the sexual response (Lonnee-Hofffmann, Dennerstein, Lehert, & Szoeke, 2014), as well as in determining feelings about one's attractiveness. Women's perception of their desirability is heightened at ovulation, when estrogen levels are at their peak (Arslan, Schilling, Gerlach, & Penke, 2018). While sex drive may also be simulated, at least in part, by androgens in women this is controversial and no conclusive evidence exists for this assumption (van Anders, 2012; van Anders, Goldkey, & Bell, 2014).



Courtesy Lucy L. Brown, Albert Einstein College of Medicine

The brain, sexual arousal, and rewards **Gazing at a photo of one's romantic partner activates the ventral tegmental area (VTA) (shown in yellow on this fMRI image). The VTA is activated during early-stage, intense romantic love, as well as when looking at photos of loved ones for which there is no sexual interest, showing that**

this brain area is associated with learning about rewarding stimuli in general.

Neuroimaging studies show that we can get aroused just by watching sexual behaviour. When people view videos of sex acts, or merely imagine them, parts of their brains such as the parietal and frontal lobes, basal ganglia, hypothalamus, and amygdala, are activated (Cheng, Burker, Fedoroff, & Dwyer, 2015; Stoléru et al., 2012). Watching other people engage in sexual behaviour activates some of the same regions of the viewer's brain that would be active if the viewer were actually having sex. This activation makes viewers feel sexually aroused simply from watching.

Even if we do not consciously see an erotic picture or film, we can become aroused. In one study, researchers presented a series of photos to participants. Some of the photos were sexual, and these were rapidly shown and removed before the viewer was consciously aware of them. Even though viewers did not remember seeing anything, neuroimaging showed activation of regions of the brain associated with arousal and reward (Childress et al., 2008; Oei et al., 2012). (See image.) Sexual behaviour is essential for survival of the species, and the rapid activation of brain regions by subtle sexual cues ensures that we are motivated to have sex.

Gender Differences in Sexuality

Although each person has unique preferences, beliefs, and behaviours, there do seem to be some differences between men and women when it comes to what they want in sex. Men and women differ in characteristics they perceive as attractive in a mate and in the stimuli that arouse them. Their fantasies and desired number of partners may also differ.

Evolutionary psychologists suggest that much of how heterosexual men and women interact with the opposite sex is the result of thousands of years of evolution designed to maximize our chances of survival and reproductive success. Men desire youthful, attractive mates because those attributes signal good odds for reproductive success; women are attracted to men who are dependable and strong because they will most likely be able to protect and care for children (Buss, 2015).

LSOphoto/Getty Images

Different needs and preferences **Given gender differences regarding sexual needs, attraction, arousal, and fantasies, a couple's thoughts may be in different places at moments like this.**

In addition to what makes someone attractive, men and women also differ in what arouses them (see photo). Men, on average, are aroused more quickly than women by visual stimuli (Li & Meltzer, 2015; Rieger et al., 2015). Women, on the other hand, respond more strongly than men do to physical contact and verbal expression. This may be because arousal in women is more often influenced by their relationship with a partner, as well as their own self-image, than it is in men (Buss, 2015).

It's important to realize that reported gender differences in sexual desire and sexual activity may reflect biases in reporting. On surveys and during interviews, women may downplay their sexual desires and behaviours because of perceived social constraints. Conversely, males may be more likely to exaggerate such feelings and behaviours to fulfill imagined expectations for men. There is no question that women and men are judged differently by society when it comes to sex. In movies, for example, women with high sex drives are often portrayed as dangerous or emotionally unstable, while men with low sex drives are often the subject of ridicule. These perceptions may influence the way that people respond to questions about their sex lives. In reality, though, women and men may be more alike than researchers once thought. Recent studies of university undergraduates are conflicted, with some finding significant differences between women and men in their desired number of partners and others not (Buss & Schmitt, 1993; McBurney, Zapp & Streeter, 2005; Pedersen et al., 2002; Schmitt et al., 2012). Interestingly, where gender differences seem to exist is in regret for missing sexual opportunities. A recent study in Norway, a relatively egalitarian society where men and women are equally likely to seek out sexual partners, men were more likely to regret missed opportunities than women (Kennair, Bendixen, & Buss, 2016).

Sexual Orientation

Questions of sexual orientation, and whether people identify as queer, asexual, pansexual, two-spirit, as heterosexual, homosexual, gay, lesbian, bisexual, or transgender, reflect how scientific, political, and social approaches to a normal aspect of human sexuality—who you are attracted to (or not)—can become intertwined in complex ways. Homosexuality used to be considered a disorder (until it was removed from the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders in 1973) and in many regions of the world is still viewed as unnatural and is even illegal. The public debate as to whether sexual orientation is biologically determined or a lifestyle choice is at the centre of these conceptual and political clashes in ways that make it difficult to gather self-reported scientific data about sexual orientation. People's political positions on the issue may influence how they respond to questions about their sexual orientation. This same issue leads to some very selective "cherry picking" from the large research literature on this topic in that people pick the studies or partial results that best match their particular socio-political views about the nature of non-heterosexual orientations. In the recent past (2014), Uganda passed the Anti Homosexuality Act, which increased prison terms for people convicted of engaging in homosexual activity. (It was originally called the Kill the Gays Act in the media because its original version proposed the death penalty for certain homosexual acts, such as having sex when infected with the AIDS virus.) Prior to the act's passage, Uganda's president, Yoweri Museveni, demanded that he be provided with scientific evidence on the question of whether homosexuality was inborn (genetic/biological) or acquired (a socially influenced lifestyle choice), indicating that he would sign the act only if evidence supported the acquired side of this question. Timelines for the evidence summary were short and so no systematic scientific review was provided. Instead, the Ugandan Health Ministry provided a statement (Aceng, 2014) and the president signed the legislation (which has since been struck down by the Ugandan Constitutional Court).

Believing there was an urgent need for a clear and detailed summary of research on sexual orientation that considered the effects of social stigma and political agendas on what research was considered and how it was interpreted, a group of prominent sexual orientation researchers, including Paul Vasey from the University of Lethbridge in Alberta, recently produced a comprehensive research review on sexual orientation (Bailey et al., 2016). The following summarizes the high points of the article.

Alfred Kinsey believed that sexual orientation was on a continuum, with many people fitting between the two extremes of exclusively heterosexual and exclusively homosexual (Kinsey, Pomeroy, & Martin, 1948). According to this idea, each person contains a certain proportion of heterosexuality and homosexuality. In the 70 years since Kinsey's research, a number of concepts and terms have been added into the mix. Sexual orientation is defined as one's relative attraction to individuals of varied genders and contains four related phenomena (Bailey et al., 2016). The first, sexual behaviour, is composed of the range of sexual behaviours a person engages in and who they engage in them with. The second, sexual identity, is how a person thinks of themselves, and their sexual orientation (Savin-Williams, 2016) regardless of whether or not they share their identity beliefs with others. The third is sexual attraction, which involves studying who a person is sexually attracted to. The fourth phenomenon that has been studied in relation to sexual orientation is sexual

arousal, which involves the extent to which a person is sexually aroused by erotic stimuli that includes individuals of different genders. If you are wondering which of these phenomena or which combination of these phenomena researchers should measure in their efforts to better understand the biological and social underpinnings of sexual orientation, then you are starting to understand the complexities of interpretation in this area.

Estimates of how people identify in relation to sexual orientation vary depending upon the questions they are asked. Kinsey used both 5- and 7-point scales for asking people to identify between being heterosexual and homosexual by degree. He reported that about 10 percent of the male population identified as exclusively homosexual (Kinsey et al., 1948). More recent research has suggested lower values, with 1.7 percent of Canadians between 18 and 59 years of age reporting themselves as gay or lesbian and 1.3 percent reporting as bisexual (Statistics Canada, 2014). Classic work by Chris Bagley at the University of Calgary argued that how you ask questions about sexual orientation and how you sample the population affects your results (for example, it is likely that there are higher proportions of gay and lesbian individuals in cities). In his study, Bagley took extra steps to make it very clear that all data gathered would carefully protect anonymity. Based on the results of his now-classic study, Bagley suggested that the rate of homosexuality in urban settings may be as high as 10 to 15 percent (Bagley & Tremblay, 1988).

There are interesting sex differences in expressions of sexual orientation in that non-heterosexual males are most likely (93.2 percent) to categorically identify as homosexual, while non-heterosexual females are more likely to identify as being somewhere along a continuum of sexual orientation (86.8 percent identify as entirely homosexual), leading the review authors to suggest that women are the “more bisexual sex” (Bailey et al., 2016). Women are also more likely to shift their sexual identification over their lives (Katz-Wise, 2015; Savin-Williams, Joyner, & Reiger, 2012).

Evidence that homosexuality is a biological phenomenon comes from repeated observations of homosexual behaviour throughout the animal kingdom. Homosexuality has been reported in both male and female birds (including one celebrated case of a homosexual penguin at the Central Park Zoo in New York City), as well as among many primate species chimpanzee (Drury, 2013; Busia, Denice, Aureli, & Schaffner, 2018; Leca, Gunst, & Vasey, 2014; Vasey, 2016).

Although the exact influences leading to sexual orientation remain unknown, considerable evidence suggests that sexual orientation has a biological basis. Bear in mind that it is not scientifically appropriate to link “choice” with acquired sexual orientation and “no-choice” with biological/genetic causal possibilities (Bailey et al., 2016). Sexual orientation, like most of human behaviour, is more complicated than that. Researchers have studied the intertwined influences of genes, hormones, and anatomical brain differences. At present there are many unanswered questions regarding the biology of sexual orientation. Scientists do know that the interaction of genes and hormones and how they affect the development of the brain are important for understanding how sexual orientation and our genders are coded into our nervous systems (Bailey et al., 2016; LeVay, 2016; Sanders et al., 2017; van Anders, 2015).

Charla Jones / Toronto Star / Getty Images

Tony Bock / Toronto Star / Getty Images

Gay marriage and the law **Former Ontario health minister, George Smitherman (left), and his partner; a couple celebrates their wedding in front of Toronto's City Hall. The relationship between the law and psychology is not always clear. Research is increasingly showing that homosexuality is a natural human phenomenon. Societal acceptance is increasing, and Canada has taken a positive step by legalizing gay marriage.**

There has been substantial socio-political debate about whether it is possible to "recruit" a young person into homosexuality or if children who are sexually abused by same-sex adults are more likely to later identify as homosexual. This question is important since the recruitment argument is used in many countries as a justification for the oppression and stigmatization of homosexuality. There are still many countries around the world where homosexuality is illegal and considered a criminal act. The review article by Bailey and colleagues (2016) discusses these questions and related research that bears upon them in detail and we encourage you to read the article if you are interested in these questions. Bailey and his colleagues conclude that research looking at the recruitment question "provide[s] no additional reason to consider the recruitment hypothesis to be a promising one" (p. 83). They also indicate that research does not support the claim that being sexually abused by a same-sex adult increases the likelihood that the child victim will grow into a homosexual sexual orientation.

Societies are gradually becoming less discriminatory and more accepting of homosexuality. Eighty percent of Canadians surveyed agree that homosexuality should be accepted (Kohut et al., 2013) and 70 percent support same-sex marriage (Forum Research, 2015). Same-sex marriage was legalized in Canada in 2005 (see photos). In 2011, a Statistics Canada study (2015) found that about 65,575 Canadian couples were in a same-sex relationship (up 42.5 percent from 2006), one-third of them married (up from one-fifth in 2006).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

10. What aspects of sexual behaviour are affected by our cultural standards?

11. What are the phases of the sexual response cycle described by Masters and

Johnson and what happens at each one?

12. What biological factors has research found to be related to sexual orientation?

What Do You Think? • Describe the specific cultural standards for sexual behaviour that affect your peer group.

Psychological Motivations: Individual Factors

LEARNING OBJECTIVE 4

Describe how unconscious/conscious, approach/avoidance, intrinsic/extrinsic, and fixed/growth mindsets affect our motivational drive.

Motivation is a term we are all familiar with, and we can often observe it in others, but it is difficult to study from a psychological point of view because it is an *inner drive*, or urge to behave in a particular way, to achieve a particular goal. We can't see motivation; we can only see its behavioural results. When we look at extraordinary athletes, for example, we know they are motivated to succeed, but what drives their motivation (see photo)? In the next section we will explore several key concepts that have increased our understanding of the psychological motivations that vary between individuals, and influence the goals we set for ourselves.

THE CANADIAN PRESS/CP

Epic motivation **Terry Fox is one of Canada's most famous athletes and heroes. In 1980, he began his Marathon of Hope when he dipped his artificial leg, replacing the leg he lost to cancer, in the Atlantic Ocean. His dream was to raise $1 for every Canadian alive to help defeat cancer. He journeyed 5,373 km before having to quit due to cancer in his lungs. He passed away from cancer one month short of his 23rd birthday.**

Unconscious versus Conscious Motivations

So what drove someone like Terry Fox to run across Canada to raise money for cancer

research? On the surface we know that he was motivated due to his own battle with cancer. Yet many people have cancer and are not motivated to run across Canada. He was also friends with Rick Hansen, a champion of individuals with disabilities (you met Rick Hansen in Chapter 3), and their friendship inspired each other. While we might know some of Terry Fox's **conscious motivations**, it is much harder to tap into his, or anyone's, **unconscious motivations**. As you read in Chapter 6, our brains process information both consciously and unconsciously and these two cognitive states can influence our motivation to act.

> **conscious motivations** motivations that people are aware of and can verbalize.
>
> **unconscious motivations** motivations that people are unaware of and cannot verbalize.

One of the challenges with studying unconscious motivations is how to access information in a person that they themselves are not even aware of. One key area of the study of unconscious motivations is second languages. Starting in the 1950s, Robert Gardner, a famous Canadian scientist who started his influential research at McGill University, began studying how our willingness, or motivation, to learn a second language is often influenced by our unconscious perspectives, such as our openness to adopting aspects of that language into our first language, and embracing aspects of the culture associated with the second language, into our own cultural and linguistic schemas (Al-Hoori, 2017; Gardner, 2010). (See photo.) While it is easy to ask a person what motivates them, and potentially tap into their conscious motivations to learn a second language, it is much harder to assess their unconscious motivations—a challenge scientists have grappled with for decades.

RichVintage/E+/Getty Images

Pourquoi? Motivation to learn a second language may be influenced by our unconscious perceptions of that language and the culture associated with it.

Two psychological tasks that attempt to tap into our unconscious motivations are the

Implicit Association Task and the Thematic Apperception Task, or TAT (Kihlstrom, 2019; Marvel & Resh, 2019). The TAT asks people to describe an ambiguous scene (see photo). The story they generate about a particular image gives psychologists a window into how that individual sees the world around them, and presumably their unconscious thought processes. For example, if you look at the TAT photo nearby, how do you interpret, or describe, the behaviour of the woman in the image? Do you see her as a mother or a wife? Is she angry or sad? Your description of the woman may give a psychologist insight into your perceptions of women, and your unconscious motivations for interacting with the women in your life in the manner you do. While this test is thought-provoking, it is not without controversy. It is difficult to determine whether there is any validity or reliability in this task, and the assessment of a person's unconscious motivations can be influenced by the unconscious motivations of the psychologist administering the TAT (Piotrowski, 2017).

Science History Images / Alamy Stock Photo

What do you see? The Thematic Apperception Task asks users to describe what they see. It is used to delve into a person's unconscious or underlying motivations which may give insight into how a person views their social world.

The Implicit Association Task (IAT) asks people to associate two things together, usually an object and an emotion or moral judgement. For example, you may see the word "tulip" and then be asked to choose between two text boxes on a computer screen, one that says "flower" and "good" and a second box that says "flower" and "bad." In this particular example, most people will choose flower and good, unless of course they have a reason to

choose flower and bad, such as an overall dislike of flowers due to a traumatic childhood memory of being stung by a bee when smelling a flower. The IAT is commonly used to assess an individual's associations between two concepts as an indication of their unconscious motivations. For example, this test is often used to assess whether we have unconscious bias toward individuals of different ethnicities. Its use has also corroborated claims by patients that health care professionals often have implicit biases toward individuals of certain ethnicities or genders that influence the care received by people in emergency rooms (Blanton et al., 2015; Dehon et al., 2017; FitzGerald & Hurst, 2017). Interestingly, use of this test has also revealed that individuals may be more biased, or prejudicial and stereotyping of others, than they believe themselves to be (Howell & Ratliff, 2017). Like the TAT, however, the IAT is not without its criticisms and controversy. It will likely take many more years of research to determine what psychological tests can reliably tap into our unconscious beliefs and motivations (Bartlett, 2017).

One thing to keep in mind is that the unconscious/conscious aspects of motivation are not an either/or dichotomy; this is also true for the concepts you will be introduced to in the remainder of this section. Like many concepts in psychology, there are intermediate states of consciousness that are not easily classifiable. The cognitions and our ways of perceiving the world, in all our various states of consciousness, likely influence our motivations to act (Norman, 2010). Recent research into the area of socially conscious consumption, for example, has shown that young people who are consciously motivated to be vegan or vegetarian are more likely to be successful at maintaining that lifestyle when they receive social support from those around them. This support may provide varying levels of unconscious and conscious motivation to continue with the lifestyle they have chosen (Cherry, 2014).

Approach versus Avoidance Motivation

It has been argued that what motivates many of us to engage in a particular behaviour is our resolve to avoid pain and our desires to experience pleasure. This motivational model of avoiding pain and gaining pleasure is often referred to as the **hedonic principle**. Two aspects of motivation that contribute to the hedonic principle are **avoidance motivation**, the desire to avoid physical or social experiences that may have a negative outcome, and **approach motivation**, the desire to experience positive outcomes or feelings from our behaviours. Both types of motivation have strengths and limitations. In our Western society, we tend to value approach motivation as our preferred way to attain personal goals, and we provide social, monetary, and prestige incentives to individuals who strive for and achieve success using this motivational strategy. Individuals who use an approach motivation style for attaining their goals often experience higher well-being and are more satisfied with their interpersonal relationships (Gable & Gosnell, 2013).

hedonic principle the principle that we avoid painful experiences and approach pleasurable experiences.

avoidance motivation the desire to avoid the experience of a negative outcome following a behaviour.

approach motivation the desire to experience a positive outcome following a

behaviour.

While on the surface it seems that we should all want to be more motivated by approach than avoidance motivation, this is not always the best choice (Scholer, Cornwell, & Higgins, 2019). It is the flexibility of an individual to be able to move easily between these two types of motivation when adapting a behavioural strategy that may be most important for attaining a goal. For example, it may be painful to avoid chicken nuggets or French fries, but the benefits for your health by using an avoidance motivation to stay away from fast food may be worth the pain. Also, by creating environments where we focus on the use of approach motivation and try to minimize pain, we may be creating an environment where individuals do not have the opportunity to learn from minor adversity and develop resilience. This lack of experience of having to use avoidance motivation strategies may leave us less able to cope psychologically with environmental challenges, and less able to realistically assess our own strengths and weaknesses (Haidt & Lukianoff, 2018; Scholer, Ozaki, & Higgins, 2014).

One question regarding approach and avoidance motivation that has received research attention is, which one is stronger? In classic work by Kahneman & Tversky (1979, Kahneman won the Nobel Prize in Economics in 2002 for this work), they proposed a new phenomenon called **loss aversion.** One quirk of humans is that when deciding to use an approach or avoidance style of motivation, we typically discount potential future gains more than future losses. In other words, we are averse to losing things, whether it is money, status, a relationship, and so on. This suggests that when all else is equal, avoidance motivation will be stronger than approach motivation. A simple example should help illuminate this: Are you more driven to have a job to gain a paycheque (approach motivation) to pay for your cell phone, or are you more motivated to work and gain a paycheque to prevent your cell phone from being cut off due to lack of payment (avoidance motivation? (See photo.)

loss aversion a tendency to be motivated more strongly to avoid a loss rather than to achieve a gain, even if the potential loss and gain are of equal size.

Neustockimages/Getty Images

Loss aversion **We work, and make money, to avoid losing items we value such as our cellphones.**

Researchers have shown that we feel the pain of a loss of income, such as if your pay was cut by 10 percent, more than the pleasure of a 10-percent increase in income (Boyce et al., 2013). This can be generalized to data collected across 150 countries showing that people are more sensitive to negative versus positive economic growth (De Neve et al., 2018). Interestingly, when people take propanol, a drug that reduces fear and anxiety, their aversion for monetary loss in the face of a risky decision is reduced (Sokol-Hessner et al., 2015). This data suggests that the immediate fear of financial loss, rather than a long-term consequence of that loss, is what underlies the phenomenon of loss aversion. The neurotransmitter systems dopamine and norepinephrine seem to be related to risk and loss aversion, respectively, and the striatum (basal ganglia), amygdala, and prefrontal cortex are key structures in the neural circuitry controlling loss aversion (Sokol-Hessner & Rutledge, 2019; Xu et al., 2020). Alterations in the activity of the neural circuitry between these structures, often seen in individuals with alcohol dependence or pathological gambling, correlates with a reduction of the feelings of loss aversion in these individuals, similar to the effects of propanol (Genauck et al., 2017).

Intrinsic Motivation, Extrinsic Motivation, and Amotivation

Take a second and think back to the chapter opener. Remember the individuals who participate in the sport of wingsuit flying? Do these people do it because they want to, or do they do it for the fame? If they do it because they want to—they inherently find the sport pleasurable and satisfying—then we assume that they are driven by an intrinsic motivation to participate in the sport. If, in contrast, wingsuit flyers and BASE jumpers are driven by the need for fame on Instagram, we assume they are driven by extrinsic motivation. The reward, likes on Instagram, are separate from the feelings that are generated by the actual behaviour of jumping from a BASE. A fascinating feature of intrinsic motivation is that when an individual is offered money to perform a behaviour, then their intrinsic motivation

to continue doing that behaviour declines (Deci, 1971; Deci et al., 1999; Marsden et al., 2015). University students who are intrinsically motivated tend to have higher academic engagement and are more emotionally creative; they have a better ability to experience and express unique and genuine blends of emotion (Froiland & Worrell, 2016; Oriol et al., 2016). Intrinsic motivation in the workplace has repeatedly been studied with the assumption that the extrinsic motivation of receiving a paycheque decreases a person's reported intrinsic motivation. Yet for some companies, the external motivator of pay can be very successful in increasing employee performance and retention. Companies such as Google, Adobe, and Facebook are well known for their high pay and rigorous work standards, yet competition for employment with these companies can be fierce (Gerhart & Fang, 2015; Truong, 2014). More research into how the psychological balance between intrinsic and extrinsic motivation affects our individual behaviour is needed, and ongoing.

Amotivation is literally "without motivation." In a school setting, individuals who are amotivated are more likely to skip class and drop out of school (Balkis, 2018). Amotivation is often fuelled by feeling a lack of competence, autonomy, and relatedness. For example, a student who is not motivated to participate in a physical education class in secondary school may feel that they can't do the task required (run 5 km), which is a lack of competence; they don't like running, which is a lack of interest; and they don't feel connected to those who like to run, which is a lack of relatedness (Reeve, 2018). While all of us at one time or another may be low on motivation, a relatively new phenomenon, *hikikomori*, described in several adolescents in Japan, and more recently a case Canada, is an example of extreme amotivation where the individual loses all motivation to interact with the outside world in a physical sense. These adolescents have no motivation to leave their bedrooms. This can last for days, months, or in extreme cases, years. In-person interactions with members of their families and friends cease and they leave their rooms only for food and bathroom breaks. The majority of their time is spent alone or in online spaces. How hikikomori relates to disorders such as schizophrenia and depression (**Figure 11.8**) remains to be determined (Stip, Thibault, Beauchamp-Chatel, & Kisely, 2016). A recent study from Finland showed that amotivation, while higher in adolescents, decreases as students shift from secondary school to work or to post-secondary study. This suggests that amotivation as a state decreases with age and with the pursuit, and completion, of higher education (Kyndt et al., 2015; Symonds, Schoon, Eccles, & Salmela-Aro, 2019).

amotivation the state of being without motivation.

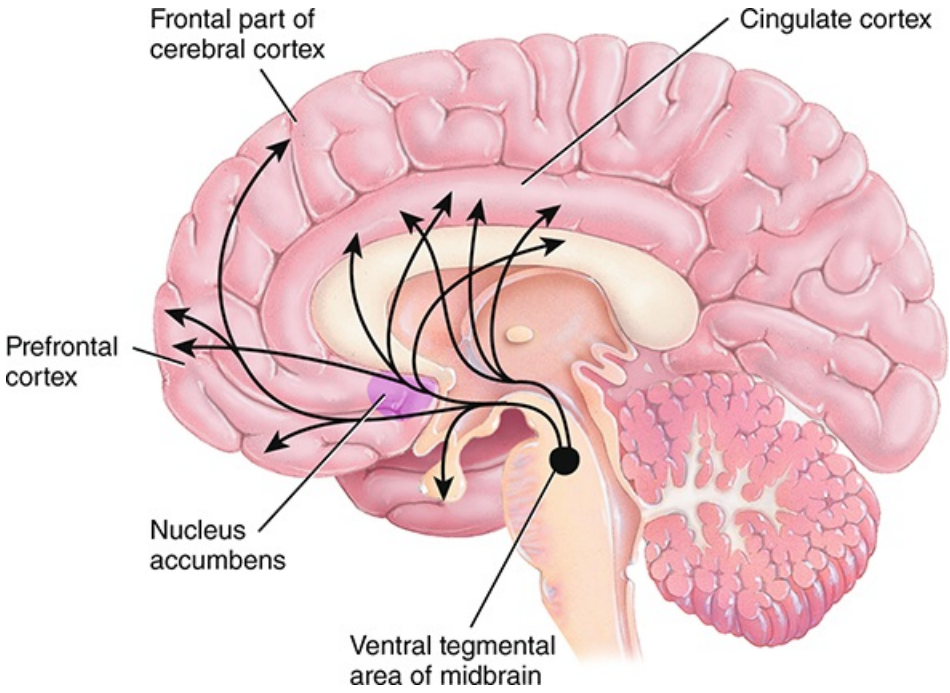


FIGURE 11.8 Neural circuitry involved in motivation. Dopamine containing axonal projects (black) from the ventral tegmental area provide input to the prefrontal and cingulate cortices as well as the nucleus accumbens. Activation of this pathway is related to positive feelings of reward and pleasure. Especially important are the connections from the nucleus accumbens to the prefrontal and cingulate cortices that further reinforce our conscious awareness of the pleasurable and rewarding aspects of a behaviour.

Several neurological disorders have been associated with amotivation. Some people diagnosed with the negative aspects of schizophrenia, such as a loss of interest in the world and other people, have lower activity in the ventral striatum (nucleus accumbens area that is important for feeling reward and pleasure), when compared with controls during a task of motivation (Wolf et al., 2014; Xu et al., 2019). Individuals who live with major depressive disorder may also lack motivation to engage in what many of us would assume are pleasurable activities. A lack of pleasure felt in activities such as sitting in the sun on a summer day, or spending time with a good friend, is referred to as *anhedonia.* The loss of motivation and the feeling of pleasure or reward is often related to lower activity in the neural connections between ventral striatum/nucleus accumbens area, prefrontal cortex, anterior cingulate cortex, and ventral tegmental area (Admon & Pizzagalli, 2015; Enneking et al., 2019; Le Heron, Apps, & Hussain, 2018; Park et al., 2017).

Fixed versus Growth Mindset and Motivation

Carol Dweck (2016) proposed the concept of a **growth mindset** as an underlying factor that drives our motivations to succeed. A growth mindset is commonly associated with people who believe that their skill sets can be developed and enhanced through hard work, listening to the advice of others, and being strategic in the goals that they pursue. This is in contrast to a **fixed mindset**, where individuals tend to believe that talent is innate, less

malleable and that a person's ability in a particular area is less likely to be improved upon with hard work and perseverance, or **grit** (Tang, Wang, Guo, & Salmela-Aro, 2019). If you think back to the beginning of this section on individual psychological motivators, do you think that Terry Fox had a growth or fixed mindset? For many of us, our motivation to succeed on a particular task is driven by what we believe is possible and can be influenced by the beliefs of those around us. Recent work looking at professors' beliefs about whether students' abilities are fixed, especially in the areas of science, technology, engineering, and math (STEM) fields, can influence the performance of their students. The belief that these abilities are fixed can have a detrimental effect on the potential success of their students, especially those already identifying with a stigmatized group. Faculty mindset can also strongly influence whether students adopt a growth mindset (Canning, Muenks, Green, & Murphy, 2019). Recent research from Indonesia showed that the adoption of a growth mindset, with regards to a person's academic ability in a challenging statistics course, can motivate students to pursue mastery of the subject and increase the effort they put into their learning; this becomes especially important for students who had experienced setbacks in their course performance (Aditomo, 2015).

growth mindset a belief that hard work and effort can improve a person's skill or talent in a particular area.

fixed mindset a belief that talent is innate and that skill in a particular area is not determined by hard work and effort.

grit long-term perseverance toward a goal.

Recent brain imaging studies have shown that neural connections between the ventral striatum/nucleus accumbens and the prefrontal cortex seem to be important for the development of both grit and a growth mindset (Bejjani, DePasque, & Tricomi; 2019; Myers et al., 2016; Wang et al., 2017). How the connectivity and plasticity of the connections between these structures is influenced by the various motivational factors described in this section, and the environment a person lives and develops in, are exciting areas of motivational research that psychologists and neuroscientists will continue to study over the next several decades (Claro, Paunesku, & Dweck, 2016; Spenner, 2017).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

13. What is the difference between intrinsic and extrinsic motivation? What is amotivation?

14. How does loss aversion work? What areas of the brain are key to the experience of loss aversion?

15. What is the difference between a fixed and a growth mindset?

16. How can unconscious processes affect our motivation?

What Do You Think? • What motivates you? What conscious (unconscious) ideas motivate you? Are you motivated more by intrinsic or extrinsic motivators? Are you more of an avoidance versus approach person? Growth versus fixed mindset?

Psychological Motivations: Affiliation and Achievement

LEARNING OBJECTIVE 5

Describe factors that influence our psychological motivations for affiliation and achievement.

The need to belong and the need for self-worth are *psychological* motivations that are just as important as biological needs to our health and happiness. These motivations make sense when we consider that humans live in tightly knit social groups, and as such our connection to our social group and our sense of worth within our group is very important.

Affiliation

Affiliation is defined as the need to form attachments to other people for support, guidance, and protection. Going to college or university is, for many students, their first experience away from home for a prolonged period of time. Suddenly, you are on your own, without the support and comfort of your family. Those first few weeks can be quite stressful, until students become acquainted with their new surroundings and meet new people (see Indigenous Experiences 11.2).

> **affiliation** the need to form attachments to other people for support, guidance, and protection.

From the moment we are born, we seek a connection with others. As we develop, relationships with friends, and later with significant others, help to raise our self-esteem. Men and women in long-term, healthy relationships have less depression and live longer (Santini et al., 2015). Even elderly spouses who provide more care to each other live longer than those who are less considerate of each other (Kaplan & Kronick, 2006).

Our motivation to belong may also explain why some individuals remain in abusive relationships and join gangs (see photo). The fear of social exclusion is a powerful motivator. In fact, when people feel excluded, the anterior cingulate cortex in the frontal cortex is activated and individuals may experience physical symptoms of pain (Cacioppo & Cacioppo, 2016; Eisenberger, 2015). In adolescents, social inclusion is a key feature of positive emotional affect and psychological health. Adolescents who are lonely are less likely to accept invitations for social events and this can perpetuate a negative cycle of exclusion from social events, which may further decrease their self-esteem and overall happiness (Vanhalst, Luyckx, Van Petegem, & Soenens, 2018; Vanhalst et al., 2015). This need for social inclusion is also important in our increasingly digital world. Individuals who are part of geographically dispersed cultural or social groups can now cultivate group

identities in ways that weren't possible even 10 years ago (Matthews, 2015). Among university and college students, this sense of online belonging and peer support is becoming a key component of the post-secondary experience, and the experience of all of us (Glass, 2018; Iannone, McCarty, Branch, & Kelly, 2018; Kaya & Bicen, 2016).

Lee Mason

Trying to make gang membership less attractive **In an effort to reduce gang recruitment, the Young Warriors Network runs a number of programs aimed at strengthening community ties within First Nations youth.**

Affiliation with others is an essential psychological need. When we are denied contact with other humans, we are not only unable to satisfy biological needs, we also lose our motivation to pursue our highest level needs: self-worth and self-actualization. We are no longer driven to achieve.

Achievement

The fact that you are reading this book means that you are motivated to go to school, study, and obtain a degree. You may choose to pursue additional degrees, or you may graduate and find a job. No matter what path you take, to satisfy the needs at the top of Maslow's pyramid, self-worth and self-actualization, you need to feel competent, engage with others, and possess control over your own life. **Self-determination** theory suggests that competence, relatedness, and autonomy are instinctive, and that they give purpose and meaning to life (Deci & Ryan, 2011). Not all psychologists agree with this theory, however. Other cultures, such as the Chinese, place less importance on autonomy, instead valuing collective effort.

self-determination instinctive feelings of competence, relatedness, and autonomy that give purpose to life.

11.2 Indigenous Experiences

Culture as Treatment for Indigenous Youth

Affiliation and belonging involves the act of being closely associated with, or connected to, a person, group, or organization. People have a basic need to belong. The need to belong is a fundamental human drive and involves the formation of enduring, positive relationships (see photo). Indeed, research suggests that well-being suffers when people do not develop a sense of belonging (Baumeister, 2012). Many Indigenous youth report feeling confused and ashamed of their identity and express a need to reclaim a sense of belonging to their culture (Barker, Goodman, & DeBeck, 2017).

Brittany Barker and colleagues from the University of British Columbia and Simon Fraser University (2017) published a commentary reviewing the evidence for "culture as treatment" as a means of countering suicide risk in Indigenous communities. Suicide is a significant problem for First Nations people and communities, both on and off reserve, as well as for Inuit and Métis people. Indigenous people die by suicide at higher rates than the national average. Overall, First Nations people experience suicide rates three times higher than non-Indigenous groups, and First Nations people living on reserve have rates twice as high as non-Indigenous people. It is important to note, though, that this rate varies widely by First Nation, with 60% of bands experiencing zero percent suicide rates. Suicide rates are similar to First Nations rates for Métis people but much higher for Inuit people. The Inuit suicide rate is nine times the national average (Kumar & Tjepkema, 2019). As a consequence, Barker and colleagues were interested in identifying a means of changing discourse about suicide and identifying a way to address this public health emergency.

Barker et al. (2017) and others have argued that suicide is another consequence of the loss of culture and identity suffered by Indigenous people due to assimilation and to the historical, social, familial, and cultural traumas inflicted on them. Chief Shawn Atleo, speaking at a First Nations forum on suicide in Indigenous youth, said, "The word 'suicide' does not exist in our traditional languages as we have no oral history of our people taking their own lives in the past" (Atleo, as cited by Barker et al., 2017, p. e208). Western frameworks for suicide prevention have proved ineffective and some research argues that this is because these approaches are culturally incompatible with Indigenous people (Wexler et al., 2015).

"Culture as treatment" is a framework that treats Indigenous suicide as a community crisis that can be addressed by revitalizing traditional values and increasing cultural identity and connectedness. Barker and colleagues (2017) note that there is little application of this framework to suicide. Instead, it has more commonly been applied as a treatment for addiction or for those at risk for addiction. For example, Margo Rowan, at the University of Saskatchewan, and her colleagues (2014) completed a scoping study using the Two-Eyed Seeing approach to examine culture-based intervention in addictions. They found that holistic cultural interventions that emphasized balance between the mind, body, spirit, and emotions as well as between traditions, culture, language, and community, were effective at improving functioning in those treated. They concluded that the "mutuality of these relationships means that they are inseparable from one's sense of personal/social responsibility and identity

that exists within a collective society" (p. 22). Barker and colleagues see this framework as applicable for treating those at increased risk for suicide.

KIKE CALVO/Alamy Stock Photo

A sense of belonging The need to affiliate with others and to be part of a group is a fundamental drive.

Erin Goodpipe, from a Regina-based intervention program for at-risk Indigenous youth, says, "what we're trying to do is insert strength into their identities" (Baxter, 2016).

Critical Thinking Questions

What does "culture as treatment" mean in the context of suicide reduction?

How has the Two-Eyed Seeing approach been applied as a treatment for addiction?

How can the Two-Eyed Seeing approach be applied as a framework for reducing suicide rates?

As you might expect, incentives often play a role in motivating us to achieve. In school, you may be motivated intrinsically by curiosity to learn new information. In other words, the behaviour may be engaging in and of itself. Or you may be motivated extrinsically by incentives. For instance, your reason for studying hard in this course may be because you are hoping to be rewarded with an A at the end of the semester (see photo). When achievement is motivated by incentives, it is often associated with competition. People who place too much value on rewards are more likely to suffer when they fail (Ryan, Huta, & Deci, 2013). If they succeed, they may think that the reward, and not their motivation, was the reason for their success. In contrast, psychologists associate intrinsic motivation with the qualities of self-determination theory: competence, relatedness, and autonomy. When you strive to do well for yourself, you enjoy yourself more (Dogan, 2015; Ennis, Hess, & Smith, 2013; Wigfield et al., 2015). Industrial/organizational psychologists aim to help

employers properly appraise the performance of their employees. To find out about this research have a look at the Psychology @Work video on Performance Appraisal.

fatihhoca/Getty Images

Achievement and motivation **Achievement, marked by our own feelings of accomplishment and by recognition from others, is an important part of our motivation—even in young children.**

Delaying Gratification

Social, or non-biological, motivations, especially those that involve incentives, are not present at birth, but are learned. In fact, incentive motivations often involve inhibiting basic biological drives to obtain the reward. Consider a restaurant server trying to earn money. If the server acted on biological instincts and ate the food off the customer's plate, then it would be difficult to keep the job and earn money.

Delaying gratification is especially important for some of the goals you set as a student. Earning a degree takes a long period of time, during which you often set aside immediate pleasures, such as social activities, in favour of studying. This type of self-control isn't always present in small children, but instead develops over time (see photo). The ability to delay gratification requires not just an understanding of the relative worth of the rewards, but also an ability to control impulses. Impulse control also develops over time. While playing, toddlers often get into physical fights over sharing toys, whereas preschool and kindergarten-age children react this way less and less frequently. Developmental psychologists have tested the ability to delay gratification in the laboratory by offering children of varying ages the choice of getting a reward right away or waiting some amount of time to get a better reward. For example, researchers might offer a child the choice of receiving a single M&M immediately, or getting a whole bag of M&Ms if they wait 30 minutes. Studies have shown that children display a wide range of abilities to delay gratification; some are much more able to do so than others (Lemmon & Moore, 2007). Related research also suggests that the ability to delay gratification in a laboratory setting may be predictive of success in other realms, including in academic and social settings (Diamond, 2013).

Video **PSYCHOLOGY@WORK**

Performance Appraisal **This video focuses on issues in performance appraisal and motivation and on how industrial/organizational psychology shows us how this can be done validly and reliably within company settings.**

One likely explanation for the fact that very young children lack the skills necessary to work toward long-term goals and delay instant gratification along the way is that their brains are not yet developed in key areas related to these tasks. The prefrontal cortex is not yet myelinated in children, and adult levels of synapses connections between neurons are not reached until after puberty (Ziegler et al., 2019). Recent diffusion tensor imaging studies, looking at connectivity between the basal ganglia and prefrontal cortex in chimpanzees, revealed a correlation: higher white matter connectivity between these two structures and the ability of individual chimpanzees to delay gratification (Latzman, Tagliatela, & Hopkins, 2015). The prefrontal cortex is not only important for mediating reward signals, but also for planning and carrying out complicated tasks that involve several steps toward the achievement of a long-term goal.

Blue_Cutler/iStock/Getty Images

Children and delaying gratification **Children have a particular amount of difficulty delaying gratification; but then, who can ignore freshly baked cookies?**

This may provide some explanation for the common observation that, compared to adults, teenagers are more likely to engage in risky behaviour, jeopardizing their futures for instant gratification. You may find that as you get older, it is easier to set your sights on goals far in the future, including several years away. You realize that your actions in the here and now will contribute to your situation in the future. These mature thought processes occur more frequently with a fully developed prefrontal cortex. Motivation, whether biological or psychological, is complex and inextricably linked with other cognitive processes, such as memory and emotion. In trying to understand why we do the things we do, it is important to remember that society and culture play important roles as well.

Whether undertaking the challenge that BASE jumping provides or trying to ace a psychology course, our behaviours illustrate that our survival is dependent on the need for purpose. Obviously many of our activities and behaviours are also accompanied by a broad range of emotions which may affect our motivational states. It is, to the nature of emotions and emotional experience that we now turn.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

17. Why are we motivated to be socially connected?

18. What are the components of self-determination theory?

19. How does delay of gratification help us reach goals?

What Do You Think? • Describe one of your long-term goals and how you might achieve that goal by dividing it into several smaller, short-term goals.

What Are Emotions?

LEARNING OBJECTIVE 6

Define emotion, types of emotion, and the components, measurement, and functions of these emotions.

How would you define emotion? Despite all the attention psychologists give to emotion, they have difficulty agreeing on exactly what an emotion is. As mentioned, over 500 words in the English language refer to various aspects or forms of emotions, from *affect*, to *mood*, to *feeling*. Perhaps it is not surprising that a unified definition has eluded scientists (Meiselman, 2016; Scheff, 2015). Nevertheless, psychologists continue to believe that human emotion is among psychology's most important topics for understanding our motivations, thoughts, moods, relationships, brain function, and psychopathology (Chapter 15; Beauchaine & Cicchetti, 2019; Berridge, 2018; Ford & Gross, 2018; LeDoux & Hoffman, 2018; Pessoa, 2018).

Components of Emotion

Most of today's theorists define an **emotion** as an individual state that occurs in response to either an external or an internal event and that typically involves four separate but intertwined components (Reeve, 2018):

A *physiological component*—changes in bodily arousal, such as increased heart rate, body temperature, and respiration.

A *cognitive, feeling, component*—the subjective appraisal and interpretation of an

individual's feelings and surrounding environment.

A *physical, behavioural component*—the expression of emotion through verbal or non-verbal channels, such as smiling, frowning, whining, laughing, reflecting, or slouching.

An emotional, behavioural component—keeping the particular emotion present (happiness) or removing it (sadness). Emotions give us a sense of purpose and motivation for action.

emotion an intrapersonal state that occurs in response to either an external or an internal event and typically involves a physiological component, a cognitive component, and a behavioural component.

Alessandra Sarti/imageBROKER/Alamy Stock Photo

The generation of emotion **Watching other animals play, like the puppies in this photo, can often lead to a feeling of positive emotion, or happiness.**

Let's look more closely at each of these components using an example of sadness. When we experience an emotion, all four are at work. A seminal study by Mauss and colleagues (2005) demonstrated how all of the four components of emotion occur together when experiencing an emotional event. In their study, participants were exposed to either a sad video (a little boy who is crying over his father's death) or a happy video (a puppy playing; see photo). In both cases, there was a correlation between the likelihood of occurrence of the four components of emotion defined above, especially between the facial and verbal expressions of how the participants felt and the feelings that they expressed, such as happiness or sadness, after watching the video.

Physiological Component

The physiological component of emotion refers to the bodily arousal we feel when experiencing a particular emotion, whether it is positive or negative. When you are nervous about giving a class presentation or going out on a first date, for example, you may notice that your heart beats faster, your hands sweat, and your mouth becomes dry. These physical manifestations of anxiety are produced by your *autonomic nervous system* (*ANS*). As described in Chapter 3, the ANS is responsible for regulating various bodily functions and the activity of specific organs, glands, and muscles (Levenson, 2014). Other physiological changes that might occur as we experience an emotion include increased blood pressure, increased blood sugar, pupil dilation, and the inhibition of intestinal action.

11.1 Your Brain and Behaviour

Motivating Ourselves to Run a Marathon

A marathon is a 42.16 km (26.2 mile) race that generally requires months of preparation. Many people follow strict regimens to help them prepare including using online apps to help them meet their training goals. Runners eagerly sign up for marathons all across the world, in all kinds of weather. What might motivate people to run?

When we are motivated to run for personal achievement, the reward learning pathways—the brain regions involved in basic biological reward, such as the ventral tegmental area, the nucleus accumbens, and the prefrontal cortex—are engaged. In addition, areas that are important for storing the memories of our past running experiences, such as the hippocampus and neocortex, are likely to be involved. The prefrontal cortex is also important for enabling us to attend to our goals and respond flexibly to changes in the terrain as we run. Will we beat our personal best?

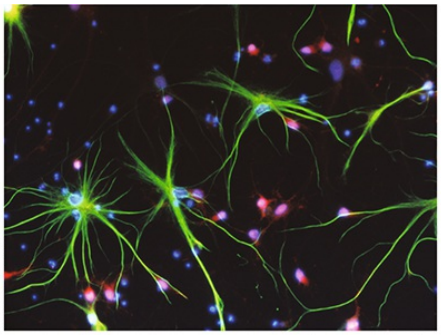
Questions

Which region of the brain is most strongly activated by attending to goals and responding to changes in the environment?

What does it mean to say that exercise has beneficial effects on the brain as well as on other parts of the body?

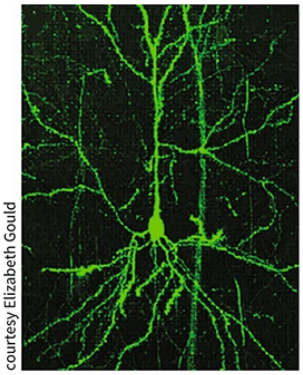
In which region of the brain is increased blood flow after aerobic exercise particularly evident?

AIC/imageBROKER/AGE Fotostock



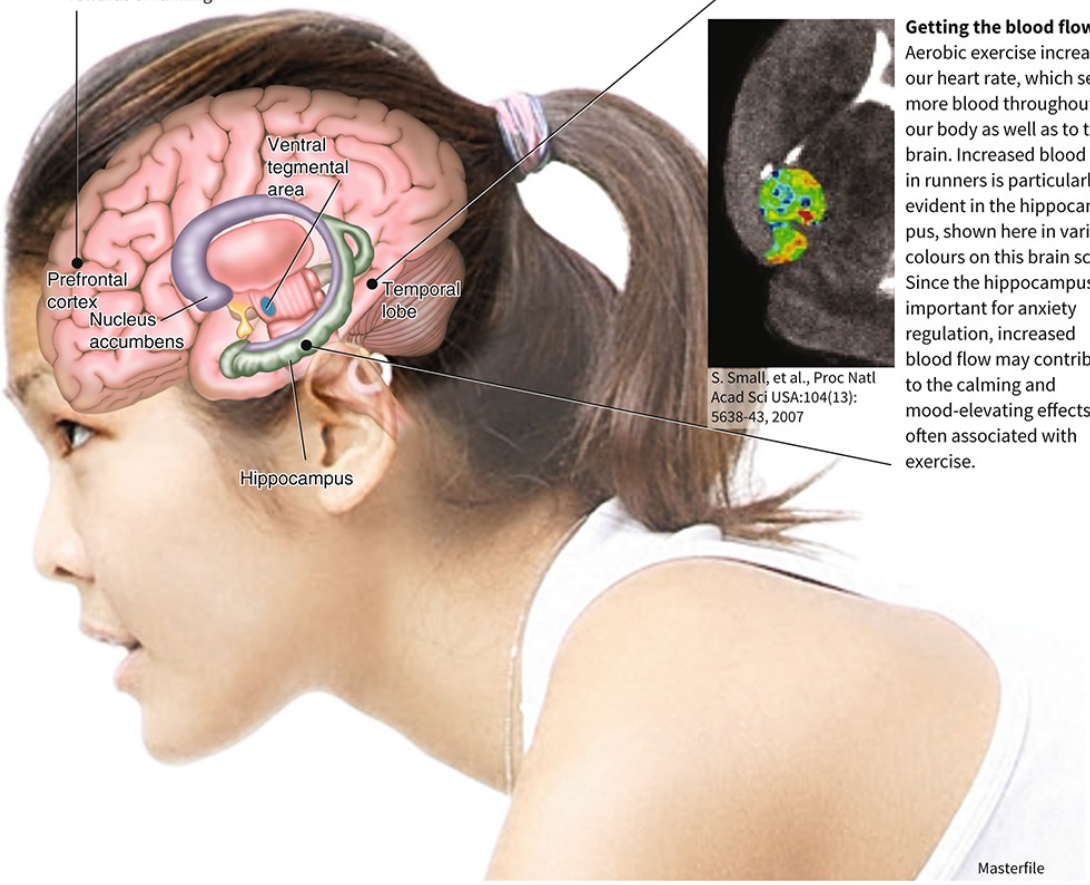
Nancy Kedersha/UCLA/Science Photo Library/ Photo Researchers

Reaping the benefits Long-term exercise increases the number of glial cells (shown here stained with green fluorescent dyes) in the prefrontal cortex, a brain region important for reward learning and cognitive function. Glial cells assist with synaptic function and provide growth factors to sustain neurons, so an increase in their number may improve prefrontal function, potentially enhancing the rewards of running.



courtesy Elizabeth Gould

Growing neurons while you build muscle One of the long-term benefits of getting in shape by running is that exercise stimulates the growth of new dendrites and new synaptic connections in the neocortex (shown here in this temporal lobe pyramidal neuron stained with a fluorescent dye). More connections likely translate into greater brain function, enhancing learning and memory.



Masterfile

S. Small, et al., Proc Natl Acad Sci USA:104(13): 5638-43, 2007

Getting the blood flowing Aerobic exercise increases our heart rate, which sends more blood throughout our body as well as to the brain. Increased blood flow in runners is particularly evident in the hippocampus, shown here in various colours on this brain scan. Since the hippocampus is important for anxiety regulation, increased blood flow may contribute to the calming and mood-elevating effects often associated with exercise.

James Mackenzie/The Canadian Press

Emotional ingredients Silpa Edmunds, 79, came to Inuvik, NT, from Labrador, to tell the Truth and Reconciliation Commission of Canada the story of how she survived residential school. She is showing physical signs of emotion, cognitive components (at least as reflected in what she is saying), and behavioural components.

Because emotions vary in intensity, some emotions may be accompanied by several physiological changes, while others may involve only a few. If, for example, you are anxious about going out with someone for the first time, you will likely experience less intense and fewer physiological reactions than if you are trying to escape from a fire in a crowded concert hall. The reason for these differences has to do with the *sympathetic nervous system*, the subdivision of the ANS that mobilizes internal resources and primes the organism to take swift action for survival—the *fight-or-flight response*. When waiting for a new date to arrive, your heart may beat faster and your palms may sweat because that is your body's way of signifying the importance of the situation to you. When you need to flee a burning building, however, more emotional arousal and energy are needed, and the body produces a more intense physiological response and different cognitive demands for emotional regulation after the event (Dixon-Gordon, Aldao, & De Los Reyes, 2015). Like fear and anxiety, emotions such as happiness, excitement, and surprise also involve activation of the sympathetic nervous system. Here, too, the intensity of the physiological arousal and the number of bodily changes depend on the nature of the situation (see photo).

Following an intense physiological reaction, the other component of the ANS, the *parasympathetic nervous system*, works to calm the body down and attempts to conserve energy by returning the organism to a normal state (**Table 11.2**). Later, we will see how various areas of the brain and the endocrine system are involved in each of these processes.

Cognitive Component

The cognitive component of emotion refers to both the evaluative thoughts people have about their emotional experiences (such as "I am afraid") and the appraisal of the events

that are producing the emotions. Our interpretation of an event not only helps bring about an emotional reaction, but also influences how intensely we will experience that emotion. Consider the event of coming face to face with a grizzly bear. If the grizzly bear is just a cub and is safely behind a protective barrier at a zoo, you will probably appraise the situation as pleasant and experience an emotion such as happiness. If, however, a full-grown grizzly bear were to appear in front of you on a hiking trail in Banff National Park in Alberta, you would likely appraise the situation as life-threatening and experience, among other emotions, very intense fear.

In addition to appraising the situation that gives rise to a particular emotion, people also interpret and evaluate the emotion itself, further shaping how they experience that emotion. If you love to ride roller coasters, you will most likely interpret the bodily arousal you feel while going into a big drop as excitement and thrill. If, in contrast, you dread roller coasters but are talked into riding one by friends, you will likely label that same bodily arousal as fear.

TABLE 11.2

Emotion and the Autonomic Nervous System

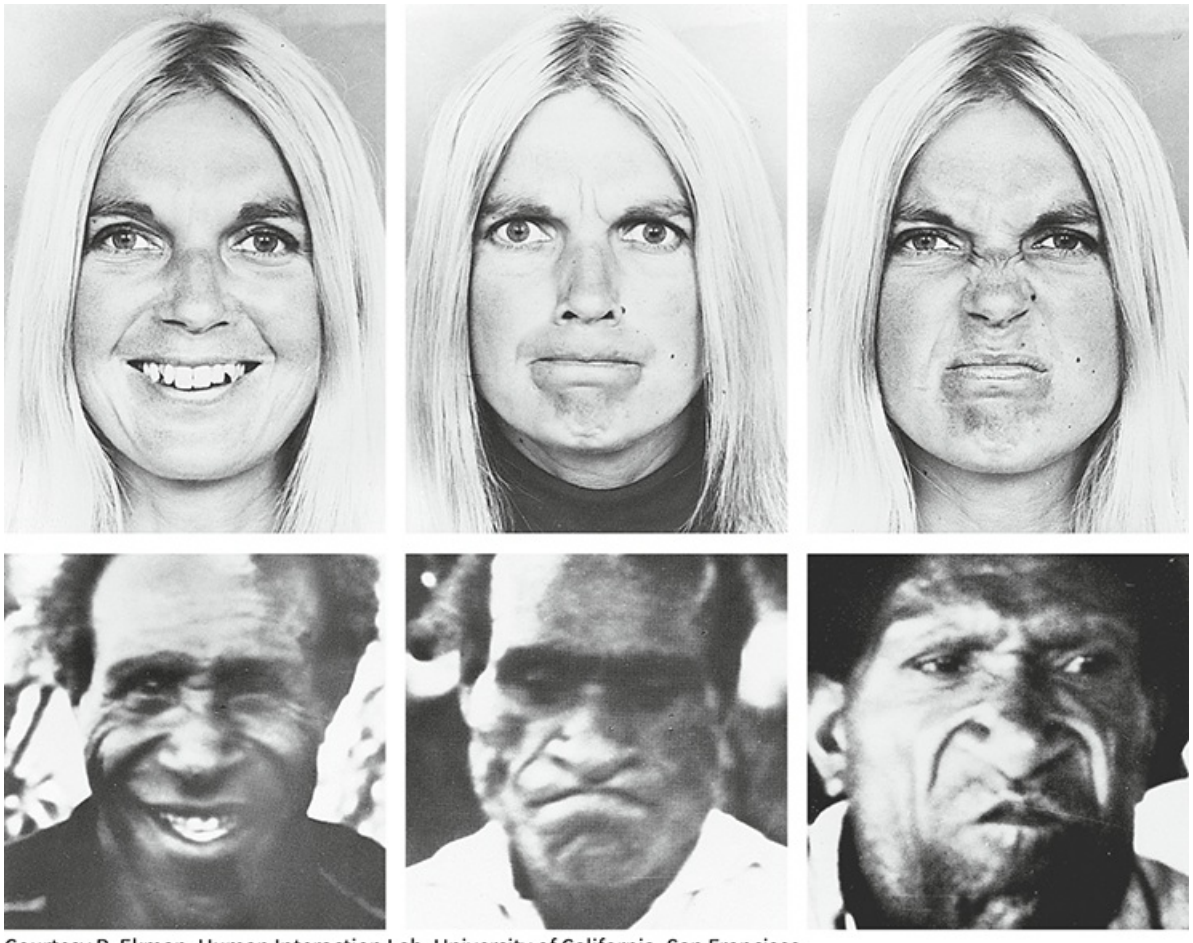
Sympathetic Nervous System Prepares the Body for Actions	Body Part or System	Parasympathetic Nervous System Returns the Body to Normal State
Pupils dilate	Eyes	Pupils constrict
Salivation decreases	Mouth	Salivation increases
Perspires; goose bumps	Skin	Dries up; no goose bumps
Breathing rate increases	Lungs	Breathing rate decreases
Accelerates	Heart	Slows
Releases stress hormones	Adrenal glands	Decreases release of stress hormones
Decreased motility	Digestion	Increased motility
Blood vessels constrict; blood sugar increases	Blood	Blood vessels dilate; blood sugar drops
Perspires	Palms	Dries up

Behavioural Component

When you experience an emotion, you not only have particular thoughts and bodily sensations, but also express and reveal that emotion. You do so through body language, such as facial expressions, gestures, and body posture, as well as through verbal expression. For example, happiness is almost universally expressed with a smile (Hwang & Matsumoto, 2015). Conversely, someone who is frustrated may cross his arms and shrug his shoulders; someone who is angry may clench her teeth and furrow her eyebrows; and a person who is sad may frown, slump, and avoid eye contact. You can no doubt think of many more examples.

Research suggests that most people are able to accurately identify the facial expressions associated with a number of basic emotions. Paul Ekman, a pioneer in the study of emotion and facial expressions, conducted a series of studies in which participants were asked to identify which emotion an individual was experiencing on the basis of the individual's facial cues (Ekman, Friesen, & Ellsworth, 2013; Ekman & Friesen, 1975). (See **Figure 11.9**.) The television series *Lie to Me* starring Tim Roth (on Fox Broadcasting Company, 2009–2011) was based on Ekman's work. Ekman and his colleagues found that research participants can typically identify six fundamental emotions: anger, sadness, happiness, surprise, fear, and disgust. In fact, some research suggests that the ability to identify the facial expressions for these emotions is genetically programmed (Barrett, Lewis, & Haviland-Jones, 2016). (See Positive Psychology 11.1.)

This would explain why Ekman's initial work showed that people from different countries and cultures seem able to recognize the same emotions depicted in photographs of facial expressions (Ekman et al., 1987; Ekman & Friesen, 1986). More recent research has suggested that the difficulty of this task varies depending on the culture of the face being read, similar to making sense of differences in language dialect from one group to another (Elfenbein, 2013).



Courtesy P. Ekman, Human Interaction Lab, University of California, San Francisco

FIGURE 11.9 Universal recognition In one study, Paul Ekman travelled to parts of New Guinea where he found that members of the Fore tribe could readily identify

the emotions of happiness, anger, and disgust expressed on a Westerner's face (top row). Similarly, he found that college students in the United States easily recognized the same emotions when they were expressed on a Fore tribe member's face (lower row).

11.1 Psychology Around Us | Positive Psychology

The Neuroscience of Happiness

To be happy or not to be happy—sometimes that really is the question. In the past decade, research exploring the neural basis of happiness has seen a dramatic increase. This increase in research has been supported by the increased availability of neuroimaging techniques to monitor the activity of the brain during experiments where participants are asked to imagine scenarios that stimulate different emotions. Imagine you are in an fMRI scanner and were asked to read a passage that is highly positive: winning the lottery or being with someone you love, for example. Contrast this to reading a passage about the death of a beloved pet. Researchers can then analyze changes in brain activity during reading of the happy versus sad scenarios and look for differences in the activity of the brain areas activated.

When researchers analyzed brain scans after this type of experiment, they found that the nucleus accumbens, which is involved in the anticipation of a reward; the amygdala, which is involved in feeling emotion; and the prefrontal cortex, which is involved in consciously assessing how we feel, are all more active during happy scenarios (Costa et al., 2010). Savouring the good feelings that can accompany a happy experience likely activates similar neural areas (Davidson & Schuyler, 2015). Happiness, like all other emotions, is a product of the brain. Recent research from the field of psychiatry suggests that working toward creating a positive outlook on life can enhance activation in these brain areas. For clinical work with patients, it has been suggested that clinicians need to take into account how practising optimism, and focusing on character strengths, may be important aspects of enhancing well-being. Activating and strengthening neural connections between areas such as the prefrontal cortex, amygdala, and nucleus accumbens that are important for our happiness may in turn support good mental health (Jeste, Palmer, Rettew, & Boardman, 2015).

Pixabay

RichLegg/Getty Images

How the brain experiences emotion Changes in brain activation patterns when contemplating happiness of being with someone you love versus the loss, or death, of a pet can lead to insights into how the brain processes negative versus positive emotions.

Although less fundamental to emotional expression than non-verbal emotional behaviours, verbal expression of emotion is also important (Kotz & Paulmann, 2011; Rimé, 2007). A recent study shows that as we grow and increase our language capabilities, in the range of ages 6 to 25 years, our verbal development enhances our conceptual representation of emotions and may enhance our actual emotional experiences (Nook et al., 2017). And, when it comes to emotions, once people get started, it's hard for them to stop talking; after someone discloses an emotional experience to another person, that person often discusses it with yet a third person. Researchers reported that this so-called *secondary social sharing* occurs in more than two-thirds of cases. The likelihood of sharing experiences increases with the intensity of the reported emotion (Duprez et al., 2015; Rimé, 2013). There are also cultural differences in the expression of emotional arousal. In individualistic Western cultures, it is common for high arousal during emotion to be valued. This is in contrast to collectivist, often Eastern, cultures, which have a preference for low arousal states of emotion. These data show that developmental and cultural influences on the development of emotional expression must be taken into account when studying emotions in a global context (Lim, 2016).

It may be that some people have particular difficulty with the cognitive processing of emotion, both their own emotions and the emotions of others. Researchers have called this difficulty *alexithymia*, and have demonstrated that people with high scores on this personality-related dimension have more difficulty remembering emotion-related words. They also have difficulties correctly recognizing angry and fearful faces, and struggle to recognize emotions in others based solely on visual cues, for example a picture of an angry face (Donges & Suslow, 2015; Nook, Linquist, & Zaki, 2015; Luminet et al., 2006). In individuals with autism spectrum disorder, alexithymia has been suggested to be a comorbid deficit that has profound implications for how we manage interactions with individuals that have both disorders (Bird & Cook, 2013; Cook, Brewer, Shah, & Bird, 2013).

Other researchers have shown that the specific areas of the brain involved in emotion processing (for example, areas of the prefrontal cortex and amygdala) are less active in individuals high on the alexithymia dimension when they are viewing emotional content (Goerlich, 2018; van der Velde et al., 2013).

An interesting aspect of the behavioural expressions of emotion is that just by pretending to express the emotion, people may begin to experience that emotion—a phenomenon you will come across again later in this chapter. It is worth noting here because it suggests a strong interdependency among the four components of emotion. As we shall soon see, this complex relationship makes the development of a comprehensive theory of emotion a daunting endeavour.

Emotional Behavioural Component

The final behavioural component of emotion (see **Figure 11.10** for a diagram of the four components of emotion using sadness) is a desire to take action to maintain or change an emotional state. If you recall from the first half of this chapter, we are motivated by a variety of internal biological and psychological factors to attain certain physiological states or personal goals. One final factor that can influence our motivational drive is our emotional state (Berridge, 2018; Reeve, 2018). For example, when a person is feeling sad due to a social loss, they may be motivated to reach out to others for support. In contrast, when they feel sad due to an imagined failure, they may be motivated to avoid others (Gray, Ishii, & Ambady, 2011). Similarly, when a person is feeling fearful and angry toward a group of people, their feelings of aggression, and their motivation to act on those aggressive feelings, are heightened (Mackie & Smith, 2015; Spanovic, Lickel, Denson, & Petrovic, 2010). Historically, several researchers have argued that emotions are the primary reason we are motivated to engage in a behaviour rather than the often-argued primary biological drivers such as thirst, food, and sex as the primary motivators for behaviour (Izard et al., 2011; Stanley, 2017). At present, scientists do not have a definitive answer about how our emotions influence our motivations but it is an exciting area of research. What we do know is that the ability to experience emotions is a core aspect of motivation and positive decision making (see Practically Speaking 11.1).

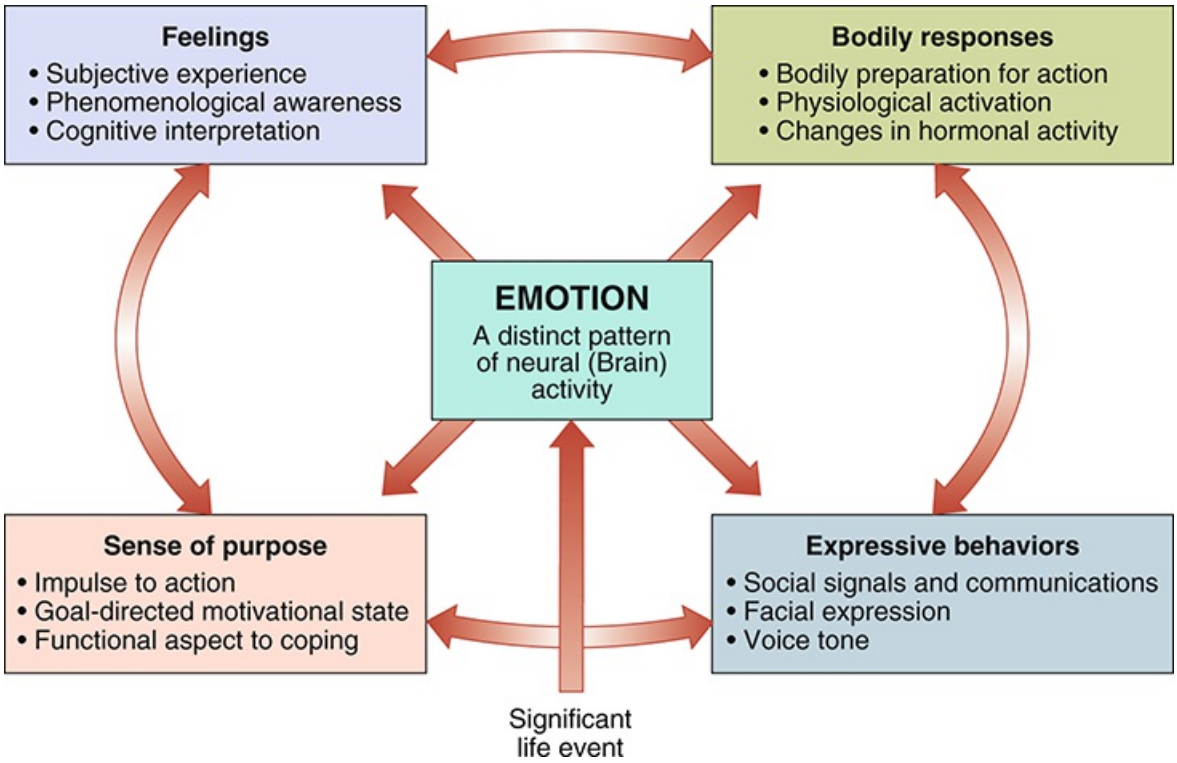


FIGURE 11.10 Emotions are a pattern of neural activity composed of four elements that interact with one another as they occur. For example, if you are experiencing the emotion of sadness you will experience the subjective feeling of sadness as a mental state. In turn this will affect your bodily or physiological state, your facial expressions, and your behaviours or actions as you attempt to deal with the sadness you are experiencing.

Source: Reeve, 2018

11.1 Practically Speaking

The Story of Elliot

Elliot was a happy man who loved his family, his wife and kids, his job. He rarely complained about his life and was always willing to pitch in to help out friends. The only thing that troubled him were agonizing headaches. If you have ever suffered from severe headaches, you'll know that they can hurt your ability to function and this was true for Elliot. He finally visited his physician, who upon hearing about Elliot's headaches promptly ordered a CT scan. The scan showed that Elliot had a tumour in his frontal lobe that encompassed both sides of the prefrontal cortex in the middle behind his eyes. Surgery was recommended and performed successfully, but afterward Elliot was changed in ways that were profound (Eslinger & Damasio, 1985).

While he still exhibited a high level of intelligence, he no longer felt any motivation to meet his personal and professional responsibilities. If his wife asked him to pick up groceries he might do it, or he might not—he no longer cared. He missed work, his children's little league games, and again he didn't care. He felt no emotion or regret

regarding missed obligations, which was completely opposite of who he was before the surgery, and eventually his wife left him. For years, he was considered a "malingerer," but in reality one of the parts of his brain crucial for motivation and emotional drive had been removed. This case, which eventually came to the attention of neuroscientist Antonio Damasio, became a game changer in how we understand the role of emotion and motivation in decision making. Damasio went on to write what is now one of the classic books in neuroscience and psychology, *Descartes' Error* (2005). His case study of Elliot provided critical evidence to support the important roles of emotion and motivation in our day-to-day decision making and to shift the neuroscience establishment from a focus on purely the role of rational thinking in decision making to incorporating how we feel.

Prior to the neuropsychological study of Elliot by Damasio, most neuroscientists believed that emotions (and their effect on motivation) weren't important for good decision making. This line of thinking can be traced back to a famous statement by the 17th century philosopher René Descartes, "I think therefore I am," hence the name of Damasio's book. Contemporary neuroscientists had continued to accept the logic of Descartes well into the 20th century with their assumption that good behavioural choices were dependent solely on rational thought.

Since Elliot's case, other published case studies have shown similar deficits in emotion and motivation after frontal lobe damage. While cognitive testing after brain injury is common, contemporary neuropsychologists have critiqued our current tests of neuropsychological function for a lack of testing questions of basic motivation, such as if a person is thirsty, are they willing to get off the couch to get a drink (Harrison, Hu, Campbell, & Harrison, 2015).

With what we now know about the importance of emotions and motivation in decision making, is there anything we can do to take conscious advantage of our emotions to make positive decisions for our lives and those of others? In a recent review on emotion and decision making, several themes were raised that are relevant for the integration of emotions into our everyday decision making (Lerner, Li, Valdesolo, & Kassam, 2015).

The role of integral emotions. How do we use emotion to make a decision about a behavioural choice that is directly in front of us? For example, the emotion of anger may motivate someone to participate in a walk for justice and equality.

The role of incidental emotions. When emotions from one event carry over and influence our decisions about how we will choose to behave in another event, we are experiencing incidental emotions. For example, the experience of the integral emotion of anger that motivated someone to participate in a walk for justice and equality may carry over to motivate them to volunteer with a local organization that promotes justice and equality.

The role of emotions in shaping decisions via goal activation. If we continue with the example of anger described above, that same anger over time can motivate us toward achieving particular goals. For example, anger over injustice and inequality may motivate us to pursue post-secondary studies in fields such as sociology, psychology, and gender studies that are related to equality and activism

research.

The role of emotions in influencing interpersonal decision making. Getting involved in activism initiatives to support equality, due to your anger at inequality, will influence who you choose to surround yourself with as friends, and potentially even your romantic partners.

While our emotional states can also lead to poor decision making, in many instances our emotions are the very motivation that gets us off the couch and out there in the world trying to make it a better place at all levels of society. Please consider using your emotional states in a positive way to support your engagement with the world around you by volunteering for local, national, or international associations that strive to support the health of our planet and all of the creatures that live on it.

Unsplash.com

Volunteering to make the world a better place **Emotions can be an essential ingredient for the decisions we make. Motivation to help those around may lead to a person volunteering for a local organization. This in turn may lead to an increase in positive emotions and our subjective sense of well being.**

Measurement of Emotions and Detecting Lies

Can you tell if someone is lying to you? Individuals are not very good at doing this, though small groups of people who score high on measures of attachment anxiety score\higher in deceit detection (Ein-Dor et al., 2016). How can you tell when someone is lying? We tend to believe that liars make less eye contact than do people telling the truth, but it turns out that is not true (Mann et al., 2012). Detecting lies has usually involved trying to detect the emotions we would expect liars to be experiencing. The problem with this approach, and the problem with polygraph machines designed to detect lies, is that many people who show emotions suggesting they might be lying are in fact telling the truth and are feeling emotions related to fear that they will not be believed (see photo). As a result, data generated through the use of classic lie detecting machines are not reliable and have not been admissible in courts of law for decades (Iacono & Lykken, 1997).

Guy Bell/Alamy Stock Photo

Emotions and psychophysiological changes **Lie detectors track some of the psychophysiological changes associated with emotions.**

When researchers attempt to measure emotion they typically use three kinds of information to measure an individual's emotions: (1) behavioural displays of emotion, (2) self-reports of emotion, and (3) physiological reactions.

Behavioural displays of emotion are most often observed by objective raters. These displays typically include obvious acts, such as fighting, fleeing, or making sexual advances. Behavioural displays may also include facial expressions. Researchers often observe behavioural displays in role-playing situations. Classically, the researchers attempt to evoke particular emotional responses from participants by showing them a film, giving them a small gift, or manipulating them in some other way (Isen, 2008, 2004, 1993), and then they measure how well the participants perform on tasks of various kinds. More recently, this type of research has been expanded and used to assess levels of emotional development in individuals with intellectual disabilities and mental health problems (Vandevelde et al., 2016).

Self-ratings are the most widely used approach to measuring a person's emotional experience. The use of such measures is based on the premise that the best way to evaluate emotional states is to simply ask individuals how they are feeling. Many questionnaires and surveys have been published that ask people to provide ratings for how happy, afraid, content, anxious, or depressed they are. However, self-reports may be inaccurate at times, as they provide only a limited picture of a person's total emotional experience and rely on a person's ability to properly identify and describe an emotional experience. For these same reasons, self-reports do not work well with children.

In recent years, researchers have developed several techniques for measuring an individual's *psychophysiological reactions* to stimuli, and have begun using such measures to assess emotional experiences (Ragot et al., 2017; Shu et al., 2018). This approach is based on the premise that emotions vary biologically from one another and assumes that there are distinct physiological patterns associated with particular emotions. These new tools allow the measurement of emotion to go beyond questionnaire-based assessments

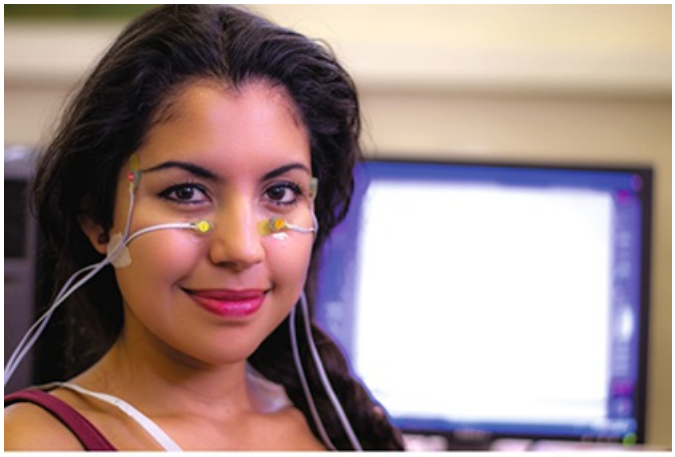
and may provide a more thorough and accurate report of many of the processes involved in the experience of emotion. Common psychophysiological approaches include facial electromyography and assessments of heart rate and skin conductance. Newer technologies use computers for facial recognition and comparison to faces with different emotions, stored in databases from individuals around the world (Abdullah, Murnane, Costa, & Choudbury, 2015).

Facial electromyography (EMG) When a person is exposed to an emotionally charged stimulus, such as a pleasant or unpleasant picture, certain facial muscles contract. A facial EMG measures these contractions (see photo). Studies have found that emotional reactions to unpleasant stimuli, such as pictures of mutilated bodies, are often associated with greater activity of the muscles used in frowning. That is, when we are exposed to distressing stimuli, we tend to lower and contract our eyebrows (Gentsch, Grandjean, & Scherer, 2014). Conversely, when individuals are shown pleasant stimuli, such as scenic images, they display heightened activity of the facial muscles responsible for smiling.

Heart rate Reductions in heart rate have been observed when individuals are presented with unpleasant/fearful stimuli, whereas pleasant stimuli are associated with accelerations in heart rate (Ragot et al., 2017; Shu et al., 2018).

Skin conductance We tend to perspire when we are emotionally aroused. One technique developed to detect and measure emotional arousal involves placing a large electrode on part of the palm of a person's hand and determining from readings of the electrode how well the skin of the hand conducts electrical activity. This technique measures what is called the galvanic skin response—or the electrical resistance of the skin—and reflects increased perspiration, so a higher conductance reading means greater arousal of emotions. Readings of skin conductance are a very useful indicator of emotional arousal (either positive or negative) and of sympathetic nervous system activity. (Christopoulos, Uy, & Yap, 2019; Li, Walters, Packer, & Scott, 2018).

fMRI Recent research has demonstrated that it may be possible to reliably detect patterns of activity in the brain associated with lying (Farah et al., 2014). Thus far this approach has proved quite accurate when used at a population level (detecting a group of people asked to lie as part of a study), but lower levels of accuracy in liar detection have been shown at the individual level. As such, this technique is not yet considered admissible in court proceedings.



Latsalomao/Getty Images

Detecting facial changes **EMG measurements indicate that each emotion is accompanied by a distinct set of facial muscle contractions.**

Although psychophysiological measures of emotion are in some respects more valid and reliable indicators of emotional states than behavioural displays and self-ratings, most investigators of emotion agree that the complexity of emotion is best measured by using multiple approaches. This also acts as a check on the possibility that we have inferred the presence of physiological reactions that may not actually be so unique. Thus, the integration of all three types of measures provides the richest picture of a person's overall emotional experience.

Functions of Emotions

Since ancient times, philosophers have often considered emotion inferior to reason, but modern researchers who study emotion have emphasized its positive effects. William James (1842–1910), perhaps the most influential emotion researcher of the last 150 years, declared that, without emotion, consciousness and cognition would be "void of human significance" (1890, p. 471). Emotions provide colour to our every experience and lie at the heart of what makes life worth living. Can you imagine riding a roller coaster without experiencing exhilaration (or fear)? How about watching your favourite movie, holding a newborn or a pet, playing your favourite sport, or spending time with your best friends without feeling some happiness or satisfaction? Without emotions, our enjoyable activities and experiences might not seem very rewarding. Clearly emotions play a large role in the meaning we take from our experiences. In this area, emotions can serve cognitive, behavioural, and social functions.

Cognitive Functions

One function of emotions is to help us organize our memories. As we discussed in Chapter 8, memories associated with emotional content are much easier to recall (Hourihan, Fraundorf, & Benjamin, 2016). Emotions also help us to prioritize our concerns, needs, or goals in a given moment. The information we gain from noticing our emotions may help us form judgments and make decisions. For example, a strong feeling of fear when you are preparing to withdraw money from an ATM at night in a dark and scary area of town will make it easy for you to decide to find a better location for your banking (Okon-Singer,

Hendler, Pessoa, & Shackman, 2015; Pychyl & Sirois, 2016).

Behavioural Functions

Emotions, whether positive or negative, can not only help us perform cognitive tasks, such as remembering relevant information, prioritizing our goals, and making decisions, they can also organize our behaviour. Generally speaking, we act to minimize our experience of negative emotions and maximize our experience of positive emotions. Such actions can involve basic behaviours, including diverting our attention away from unpleasant or disgusting images in favour of more neutral or positive images, as well as more complex behaviours, such as procrastination. You have probably noticed a correlation between how terrible you believe the experience of working on a homework assignment will be and how long you delay starting that assignment. In contrast, it is very easy to find time for tasks that we find enjoyable or pleasurable, such as spending time with a partner, and these tasks are hard to delay. In this way, our emotions can help us organize our behaviours (although admittedly in ways that sometimes run counter to what is in our best interest).

Some theorists describe emotions as indicators that serve a valuable information function, telling us how to respond appropriately to events in our environments (Frijda, 2010). Many theorists also believe that particular emotions are associated with predictable patterns of behaviour, sometimes called *action tendencies*, which help us to adapt and survive in our social and physical environments (Frijda, 2010; Aldao, Sheppes, & Gross, 2015). Specific action tendencies associated with key emotions include the following:

> *Happiness* results when people engage in rewarding behaviours or positive interactions. Because they feel happiness and joy, they will likely continue to engage in those behaviours or interactions (see photo). Happiness and joy also signal to people that particular goals have been attained (Briki, 2020; Hennecke & Brandstätter, 2017).
>
> *Embarrassment* often evokes forgiveness and motivates reconciliation and adherence to social norms. Consider, for example, that you tell one friend you are busy studying and then, when another friend asks you to go to a movie you want to see, you change your mind about studying and go to the movie. You run into the first friend at the movie. Embarrassment may not only lead you to apologize profusely, but also help to ensure that you will not do such a potentially hurtful thing again. Similarly, guilt directs people's awareness toward their transgressions and may trigger conciliatory efforts, personal change, and self-improvement (Higgs, McIntosh, Connelly, & Mumford, 2020; Pavlova & Bobyl, 2018).
>
> *Anger* signals the presence of injustice (perceived or real) and prompts aggression, as well as other self-protective behaviours (Bondü & Richter, 2016; Mill, Kööts-Ausmees, Allik, & Realo, 2018).
>
> *Anxiety* directs a person's attention toward real or perceived potential threats and motivates appropriate action to avoid or cope with them (Jazaieri, Morrison, Goldin, & Cross, 2015; Schäfer et al., 2017).
>
> *Sadness* may signal the loss of positive relationships and help people to seek needed support and assistance from others (Lench, Tibbett, & Bench, 2016).

Image Source Trading Ltd/Shutterstock.com

"Let's do this again soon" Emotions can be viewed as messengers that predict particular action tendencies. A family gathering brings this family so much joy, they are likely to repeat the activity again and again.

Research suggests that the avoidance of negative emotion is typically a more powerful motivator than the achievement of positive emotion (McMahan et al., 2016).

Social Functions

Another important function of emotions appears to be coordination of relationships. Emotions form the foundations of relationships by helping us develop a sense that we like and trust another person. Emotions, even when they are negative, can also improve the quality of our relationships. Research suggests, for example, that the more married couples talk (or text) about their feelings, the happier they are (Driver, Tabares, Shapiro & Gottman, 2012; Luo & Tuney, 2015). Stéphane Côté and Ivona Hideg at the University of Toronto have shown that the ability to influence the behaviours, attitudes, and emotions of others through emotional displays is positively related to perceived workplace competence (Côté & Hideg, 2011) and that empathic emotion, the ability to sense or feel the emotions of others, is a key factor in the perception of work performance by both employees and their employers. Research into the social functions of emotions in the workplace is ongoing (Sadri, Weber, & Gentry, 2011; Connelly & Gooty, 2015).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

20. What system produces the bodily arousal associated with emotions?

21. What three types of information are most commonly used by researchers to measure emotions?

22. Name three physiological indicators of emotional state.

23. What are the major functions of emotion?

What Do You Think? • Think about the BASE jumping activity described in our opening example and describe what you think are the physiological, cognitive, and behavioural motivational components of those who participate in such activities.

Theories of Emotion

LEARNING OBJECTIVE 7

Discuss the major theories of emotion, and identify the pathways through which emotions are experienced according to each theory.

How do emotions occur? What causes them? How have they evolved in the human species? How do they develop in individuals as they move from infancy to adulthood? And what's going on in the brain while all this is happening? These are the core questions for understanding emotions, and we will turn to them next.

Since the birth of psychology, a number of theories have been proposed to explain how emotions occur and what causes them. The most prominent of these theories are: the James-Lange theory, the Cannon-Bard theory, the Schacter and Singer two-factor theory, the cognitive-mediational theory, and the facial-feedback theory. Each theory proposes a different explanation of the sequence of an emotional episode, and each emphasizes a particular component of emotion (physiological, cognitive, or behavioural). In addition, evolutionary theory has important things to say about the origins of emotion.

James-Lange Theory

As we observed earlier, William James was the earliest and one of the most influential psychologists to study emotion. James took issue with the conventional common-sense explanation of emotion, which suggested that an event triggers an emotion, which leads to physiological changes, followed by a behavioural response to the situation.

James (1884, 1890) argued that emotions actually work differently. He suggested that an emotion begins with: (1) the perception of an environmental situation or event, followed by (2) the elicitation of physiological and behavioural changes, which are then (3) processed by the cortex and converted into felt emotion. James believed that our physiological response to a stimulus occurs prior to, and provides the basis for, the experience of a particular emotion.

In 1885, a Danish physiologist, Carl Lange (1834–1900), published a theory of emotion that was very similar to James's. Both theorists believed that there is no emotion to experience unless it is driven by a physiological component (Davidson, Jackson, & Kalin, 2000). Their views are collectively referred to as the **James-Lange theory of emotion**.

James-Lange theory of emotion a theory proposing that felt emotions result from

physiological changes, rather than being their cause.

Although the two theories are very similar, they do have a few key differences. Whereas James believed there is a place for cognition in the context of an emotional episode, Lange viewed mental activity as having little to do with emotion. Lange (1885) postulated instead that the *vasomotor centre*, a collection of nerves and muscles that cause the blood vessels to constrict or dilate, is the root cause of all emotion: "We owe all the emotional side of our mental life, our joys and sorrows, our happy and unhappy hours, to our vasomotor system" (p. 80). **Figure 11.11** compares the James-Lange theory with the two theories that we will turn to next, the Cannon-Bard theory and the Schachter and Singer two-factor theory.

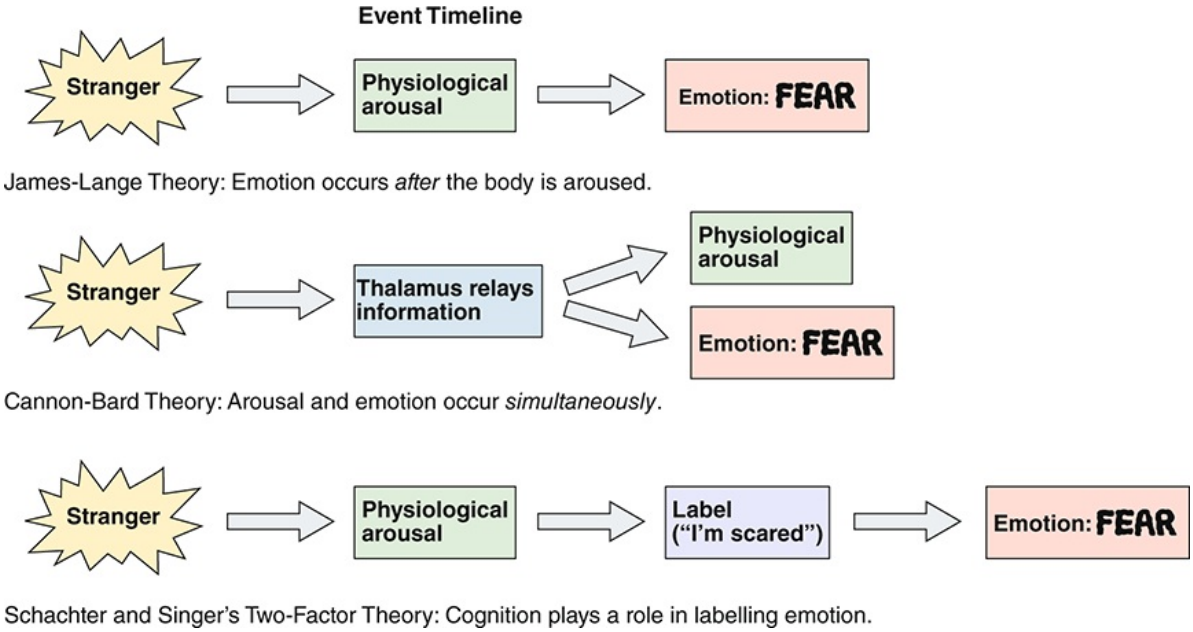


FIGURE 11.11 Three major theories of emotion The three major theories of emotion have different ways of accounting for how someone surprised by a stranger would react emotionally.

Cannon-Bard Theory

The James-Lange theory of emotion produced quite a stir in the fields of psychology and physiology, and much research was published disputing various aspects of the theory. The leading critic of the James-Lange theory was Harvard psychologist Walter Cannon (1871–1945). Central to Cannon's criticism was the James-Lange theory's notion that *visceral organs*—that is, our internal organs in which physiological arousal occurs, such as the heart—can produce complex emotional experiences. Pointing to a number of research findings, Cannon disputed the accuracy of the James-Lange theory on five different points (1927):

> *Total separation of the visceral organs from the central nervous system does not alter emotional behaviour.* Cannon cited research on dogs and cats whose vasomotor centres had been disconnected from their central nervous systems. Even without the vasomotor centre that Lange believed to be of utmost importance, cats and dogs continued to display aggression and rage in the usual way (Bard, 1934). Similarly,

more recent studies indicate that most human patients with spinal cord injuries continue to experience emotional excitability that is similar to their functioning prior to injury; some actually report an increase in the intensity of particular emotions (Bermond, Nieuwenhuyse, Fasotti, & Scheurman, 1991; Chwalisz, Diener, & Gallager, 1988).

The same visceral changes often occur in different emotional states and in non-emotional states. Recall that the arousal associated with emotions arises from the sympathetic nervous system. Cannon argued that, because the activity of the sympathetic nervous system is typically general and non-specific, several emotions probably share similar patterns of visceral activity. Cannon further noted that certain non-emotional events, such as fever, produce patterns of sympathetic nervous system activity that are similar to the patterns that accompany emotions, although they are not experienced as emotions.

The viscera are rather insensitive structures. According to Cannon, "We can feel the thumping of the heart because it presses against the chest wall, we can also feel the throbbing of the blood vessels because they pass through tissues well supplied with sensory nerves . . . [but], normally, the visceral processes are extraordinarily undemonstrative" (1927, p. 111).

Visceral changes are too slow to be the source of emotional feeling. Cannon argued that the amount of time it takes for the body's vasomotor system to communicate with the brain and send impulses back to the rest of the body is too slow "to be the occasion for the appearance of affective states" (1927, p. 112).

Artificially inducing visceral changes does not produce strong emotions. Citing research by Spanish psychologist Gregorio Marañon (1924), Cannon pointed out that the injection of adrenalin, a stimulant, into the bloodstream of research participants, which activates the sympathetic nervous system and produces visceral changes characteristic of intense emotions, does not lead to discrete and identifiable emotional reactions.

Following his critique of the James-Lange theory, Cannon (1927) offered his own explanation of emotion, which was later elaborated on by Philip Bard (1934). This theory, often referred to as the **Cannon-Bard theory of emotion**, states that when we perceive an emotionally stirring event, the *thalamus*, a key brain structure, simultaneously relays information about the event to both the sympathetic nervous system and to the parts of the brain that are active in thought and decision making. As a result, the subjective experience of emotion and the activation of the sympathetic nervous system (that is, bodily arousal) occur simultaneously (see Figure 11.11 again).

Cannon-Bard theory of emotion a theory proposing that the subjective experience of emotion and the activation of the sympathetic nervous system (that is, bodily arousal) occur simultaneously.

Schachter and Singer's Two-Factor Theory

In 1962, Stanley Schachter and Jerome Singer, American social psychologists, published a

landmark study that helped change psychology's understanding of emotion. According to Schachter and Singer (1962), earlier theories had neglected to consider the influence of cognition, or thought processes, in our emotional experiences. Physiological differences alone are too subtle to define specific emotional states, said these researchers; it is our cognitive appraisal of the immediate situation that provides a label ("I am afraid") for our bodily feelings.

Agencja Fotograficzna Caro/Alamy Stock Photo

Theories of emotion **The timing of and relationships among the situations we find ourselves in, our internal physiological arousal, and our interpretations of what our circumstances mean to us are all part of the various theories of emotion. While no child likes getting shots, how intensely he or she responds can vary by age and culture.**

According to **Schachter and Singer's two-factor theory of emotion**, "It is the cognition which determines whether the state of physiological arousal will be labeled as 'anger,' 'joy,' 'fear,' or 'whatever'" (Schachter & Singer, 1962, p. 380). Schachter and Singer suggested that, although physiological arousal is *necessary* for an emotion to occur—in fact it determines the intensity of the emotional experience—it's up to our cognitive faculties to determine our specific emotional state (see Figure 11.11).

Schachter and Singer's two-factor theory of emotion a theory proposing that an emotional state is a function of both physiological arousal and cognition.

If we were to apply Schachter and Singer's two-factor theory to the situation of a child receiving a shot, we would assume that the severity of the child's actions was determined by his level of physiological arousal. If his arousal had been mild or moderate, he might have appraised the situation differently ("This is not so bad") and might have responded in a mildly fearful or stressful way (making a face or saying "ouch"). If instead he experienced intense physiological arousal and appraised the situation in a way that led to terror ("This is going to be unbearable"), this would make him respond in ways that ultimately make the situation much more difficult (see photo).

Schachter and Singer's two-factor theory also suggests that, when the cause of our physical arousal is not immediately clear to us, we use cues from our surroundings to help us identify a cause. This can lead to mislabelling physical arousal from a non-emotional source as an emotion. Schacter and Singer (1962) conducted a well-known experiment at the University of Minnesota to test this idea (see **Figure 11.12**). They told undergraduate research participants that the study was examining the effects of a vitamin supplement (they called it *Suproxin*) on vision.

When the students arrived at the lab, they were met by an experimenter and told that they would be receiving a small injection of Suproxin and then would complete several vision tests. The participants received an injection of either epinephrine (adrenalin) or a placebo (saline solution). By producing physiological arousal, the epinephrine injections mimicked sympathetic nervous system activation. Among those who received epinephrine, one-third (the *informed group*) were told they might experience side effects, such as palpitations, trembling, and facial flushing; one-third (the *deceived group*) were told they would experience no side effects; and one-third (the *misinformed group*) were told they would experience side effects that were not in fact likely to occur, such as headaches. All the participants in the placebo group were told they would have no side effects from their injections. After the participants were given the drug, a confederate of the experimenters' entered the room and acted either euphoric or angry. These manipulations allowed Schachter and Singer to create a scenario in which participants experienced bodily arousal either with or without plausible explanations for it.

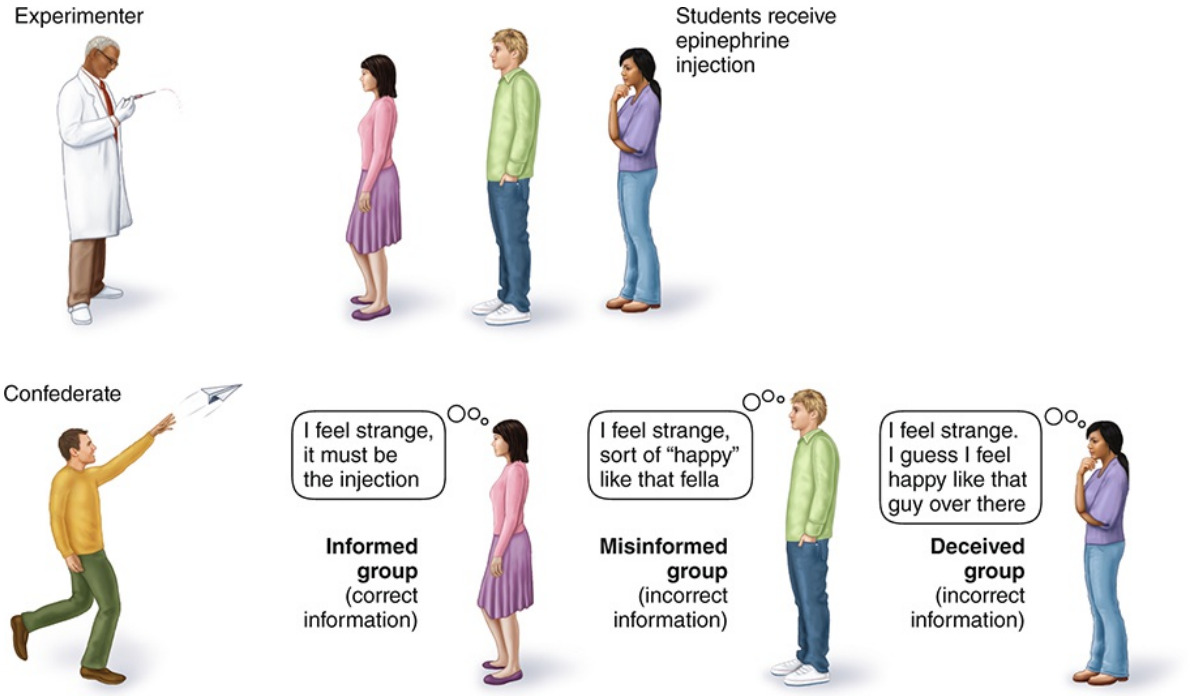


FIGURE 11.12 Testing the two-factor theory In the absence of correct information, participants in the deceived and misinformed groups who received the epinephrine injection concluded that they were feeling happy, like the confederate who had acted euphoric.

As Schachter and Singer's two-factor theory had predicted, students who received an epinephrine injection but were not given a proper explanation for their bodily arousal (the deceived and misinformed groups) later reported feelings of anger or euphoria when they encountered an angry or euphoric confederate (acting that way on the instructions of the experimenter). In contrast, students in the epinephrine condition who were told to anticipate various symptoms of sympathetic nervous system activity (informed group) did not experience anger or euphoria—they were immune to any effects of the arousal manipulation. Clearly, the label of an emotion is influenced by whether or not a person has an appropriate explanation for the arousal.

Schachter and Singer's two-factor theory served to redirect the focus of emotion research toward the role of cognitive factors. Indeed, a number of studies have since provided indirect evidence for their two-factor theory. In a classic study conducted by Don Dutton of the University of British Columbia, for example, male participants were approached by an attractive female (a confederate of the researchers) and asked to complete questionnaires. Males approached by the woman while crossing the Capilano Suspension Bridge in British Columbia—a long, narrow footbridge constructed of wooden boards and wire cables suspended about 30 metres (100 feet) above a river and near very dramatic falls—later reported being more attracted to the female confederate than males who met the same woman on a wider, sturdier bridge only about 3 metres (10 feet) above the river (Dutton & Aron, 1974). The researchers concluded that the men on the shaky Capilano Bridge had experienced anxious arousal because of the height of the bridge and had misinterpreted this arousal as sexual attraction—findings consistent with Schachter and Singer's two-factor theory (see photos).

Photo by Wendy J Photography, www.wendyjphotography.com

Kemter/Getty Images

Echoes of the Capilano Bridge study **The couple on the left pose for wedding pictures on the Capilano Suspension Bridge in North Vancouver. This wooden-**

boarded, not-so-sturdy footbridge stands high above the water and near the sounds of water pouring over the top of the Capilano dam. If asked, they might well talk more about their strong feelings for each other rather than any fear induced by the swaying bridge and sounds of rushing water. What about the couple on the right on their much lower, less threatening bridge?

Cognitive-Mediational Theory

One theory that built on Schachter and Singer's ideas was developed by Richard Lazarus, an influential psychologist at the University of California, Berkeley. Lazarus spent much of his career investigating the role of appraisal in people's reactions to stress (Lazarus, 2007; Lazarus et al., 1965; Lazarus & Alfert, 1964). Eventually, Lazarus came to believe that appraisal must play a similar role in emotional experiences to that which it plays in stress reactions. Unlike Schachter and Singer's two-factor theory, Lazarus's theory holds that appraisal affects not only how people interpret physical arousal, but also the level of arousal itself. As such, the **cognitive-mediational theory of emotion** views cognitive interpretations of events as playing a still broader role in the experience of emotion.

> **cognitive-mediational theory of emotion** a theory proposing that cognitive interpretations, particularly appraisals, of events are the keys to experiences of emotion.

In one of his early studies, for example, Lazarus and his colleagues had participants watch stressful films (featuring, for example, skin-piercing rituals among Australian tribesmen) while their autonomic nervous system activity was measured and their subjective reports of stress were recorded. Some of the viewers were told "the people in this film were not hurt or distressed by what is happening," while others were told, "many of the people you see in this film suffered severe pain and infection from these rituals." By influencing the way the participants construed what was happening in the films, Lazarus and his colleagues found they could greatly alter the participants' physiological activity and subjective stress reactions while viewing. That is, appraisal serves as a *cognitive mediator* between environmental stimuli and people's reaction to those stimuli (Biggs, Brough, & Drummond, 2017; Lazarus, 2007, 1993a, 1993b).

Facial-Feedback Theory

We mentioned earlier, in discussing the behavioural component of emotion, that people may begin to experience an emotion just by pretending to express it. Related to this observation is the **facial-feedback theory of emotion**, which is derived from Charles Darwin's early (1872) notion that muscular activity can either strengthen or lessen the experience of emotion. According to the current facial-feedback perspective, our subjective experiences of emotion are influenced by sensory feedback we receive from the activity of our facial muscles, our **facial efference** (Finzi & Rosenthal, 2016; Izard, 2007, 1997, 1977). Thus, facial expressions not only express a given emotion, but also intensify the physiological experience of that emotion.

> **facial-feedback theory of emotion** a theory proposing that subjective experiences of

emotion are influenced by sensory feedback from facial muscular activity, or facial efference.

facial efference sensory feedback from facial muscular activity.

In one study, for example, participants were directed to move their facial muscles into certain positions, without directly being told which emotions they were expressing. The facial changes produced significant changes in their autonomic nervous system arousal, as indicated by increases in their heart rates, skin conductance, and finger temperatures (Ekman, Levenson, & Friesen, 1983). In a related study, research participants held pens in their mouths while rating the funniness of cartoons (Strack, Martin, & Stepper, 1988). This approach enabled the experimenters to manipulate the participants' facial expressions without calling attention to their facial activity or to the emotions normally associated with that activity. People directed to hold the pen in their teeth made a face similar to a smile, while those directed to hold the pen with their lips were unable to smile (**Figure 11.13**). Sure enough, individuals who held the pen in their teeth found the cartoons funnier than those who held the pen in their lips. Check this out for yourself. Have several friends hold a pen in their lips for minutes and then ask them to rate their level of happiness on a 1 to 10 point scale. Have another group of friends hold a pen in their teeth for minutes and then rate their happiness on the same scale. Which group had the highest average happiness ratings?

The facial-feedback theory of emotion has also been supported by studies of the *Duchenne smile*, named after French neurologist Guillaume Duchenne. Duchenne observed that smiles reflecting genuine emotion involve the activity of certain muscles near the mouth and the eyes, whereas more artificial "social smiles" involve only muscles near the mouth (see **Figure 11.14**). One experiment found that participants who displayed genuine Duchenne smiles while viewing a positive film clip displayed greater physiological arousal and experienced more positive emotion than other participants (Krumhuber, Likowski, & Weyers, 2014). Apparently even preschool children expect more pro-social behaviour from people who display genuine (non-fake) smiles (Song, Over, & Carpenter, 2016).

How might facial expressions produce physiological arousal and the subjective experience of emotion? Several explanations have been proposed. It may be that facial expressions serve as *relays* between an emotionally stirring event and a resulting subjective experience of emotion. Indeed, psychologist Silvan Tomkins (1962) argued that emotionally stirring stimuli activate an inborn, almost reflexive "affect program" that sends signals throughout the body by motor and circulatory pathways, bypassing the parts of the brain involved in cognition. The body reacts to these signals in forms, such as facial expressions (smiles, frowns) and other activities, which then supply sensory feedback to the brain, producing the experience of an emotion. Tomkins (1992, 1980) further argued that receptors in the face change position when people contract their facial muscles and that this sensory information is also sent to the brain, ultimately leading to a felt emotion.

Mark Owens/John Wiley & Sons, Inc.

FIGURE 11.13 Testing the facial-feedback theory When you hold a pen between your teeth, you activate facial muscles that are associated with a smile and you are more likely to report pleasant feelings than if you held the pen between your lips (Strack, Martin, & Stepper, 1988).

Courtesy Karen Huffman

FIGURE 11.14 Genuine versus artificial smiles Real or Duchenne smiles reflect genuine emotion and involve muscles near the mouth and the eyes (*left*). Social or artificial smiles involve only muscles near the mouth (*right*).

Masterfile

Negative emotions While we may all recognize emotions such as sadness how the brain creates the behavioural expression of sadness may differ between individuals.

It is important to note that none of the theories just discussed seems to explain emotion completely. As psychologist Robert Zajonc has said, "It is unlikely that all emotions have the same etiology (see photo), are characterized by the same affective and cognitive processes, . . . or have the same underlying neuroanatomical structure and neurochemical actions" (Zajonc et al., 1989, p. 412). Thus, one emotional experience may result largely from a singular source, such as physiological arousal, cognitive appraisal, or facial expression, while others may be the product of a combination of these factors (Barrett, 2016; Cowen & Keltner, 2018; Kragel & LaBar, 2016).

Evolutionary Theory

In 1872, having noted the similarities in emotional expression across and within species throughout the world, Darwin published *The Expression of the Emotions in Man and Animals*. Here he argued that emotional expression in both people and animals serves a *communicative* function that is essential to survival. Emotional expressions may, for example, warn others of danger, dissuade enemies from attacking, or signal sexual receptiveness (LeDoux & Hoffman, 2018).

Evolutionary psychologists argue that certain emotions have been passed down through the generations because they have played an integral role in the survival of our species (Al-Shawaf, Conroy-Beam, Asao, & Buss, 2016; Cosmides & Tooby, 2013; Austad, 2020; Ketelaar, 2015). It may even be that each emotion corresponds to a particular situation that has occurred repeatedly throughout the course of evolution, and that each emotion increases an individual's ability to cope with the adaptive challenges that arise in such a situation (see **Table 11.3**). For example, organisms that experienced fear when confronted by predators most likely survived at a much higher rate than those that experienced calm during such interactions. Over time, as this situation was repeated, fear became a characteristic response to danger and, eventually, an innate, prewired, and automatic response. Such patterns of emotionality have been genetically passed on to us from generations of ancestors, making our lives much easier than if we were required to learn about every aspect of our environmental surroundings without their guidance.

Much of the research support for an evolutionary explanation of emotion centres on the universal and innate nature of facial expressions of emotion. As we observed earlier, Paul Ekman and his colleagues have conducted a series of studies on facial expressions of emotion (Cohn, Ambadar, & Ekman, 2007; Ekman, 2003; Ekman & Friesen, 1971). They found that individuals from many different cultural and language backgrounds, when presented with photographs of different facial expressions, are fairly accurate at selecting the emotions being expressed.

Based on such research on the universality of certain facial expressions and the evolution of emotion, a number of theorists have suggested that some innate, **basic emotions** are preprogrammed into all people, regardless of culture or country of origin, and have been shown to correspond to key areas of the brain (Saarimäki et al., 2016). Tomkins (1962) has proposed that there are eight basic emotions: surprise, interest, joy, rage, fear, disgust, shame, and anguish. Other notable theorists have proposed similar lists (Frijda, 1986). Indeed, it appears that infants typically display the facial expressions of such fundamental emotions very early in life (Izard, 1994). Even children who are born without sight display facial expressions similar to those of sighted children of the same age (Galati et al., 2003;

Goodenough, 1932).

basic emotions a group of emotions preprogrammed into all humans regardless of culture.

TABLE 11.3

Evolutionary Links Between Emotion and Behaviour in Humans and Other Animals Source: Adapted with permission of John Wiley & Sons, Inc., from Kowalski, R., & Westen, D. (2009). *Psychology* (5th ed.). Hoboken, NJ: Wiley, p. 361; data from Plutchik, R. (1980). *Emotions: A psychoevolutionary synthesis*. New York: Harper & Row.

Situation	Emotion	Survival Function
Threat	Fear, terror, anxiety	Fight, flight
Obstacle	Anger, rage	Biting, hitting
Potential mate	Joy, ecstasy, excitement	Courtship, mating
Loss of valued person	Sadness, grief	Crying for help
Sudden novel object	Surprise	Stopping, attending

Emotions and the Brain

As you have read in the preceding sections, many factors influence our experience of emotions. These include our experiences, memories, and even our cultures. Many emotions can also be felt simultaneously. For example, most of us feel anger, sadness, and disgust when we see photos of elephants and rhinoceros that have been killed by poachers. These feelings have been coded into your brain via educational experiences and the memories we have created based on what we've learned about the detriments of poaching. In contrast, if you are a poacher, you may feel surprise and happiness when you find the animal you were looking for. Thus, our experiences and cognitions interact with our brain circuitry to create the emotions we "feel." While certain areas of the brain are important for the experience of emotion (see **Figure 11.15**), the wiring or circuitry between these structures is also critical for our experience of emotion (Hoemann, Gendron, & Barrett, 2017; Kragel & LaBar, 2016).

Most of us, at some point in our lifetimes, will feel all of the six basic emotions described by Paul Ekman: anger, sadness, happiness, surprise, fear, and disgust. What scientists now understand is that many of us also feel mixed emotions or nuances of these emotional states. Saarimäki and colleagues (2016), using fMRI imaging, scanned the brains of individuals while they watched movies that distinctly elicited one of the six basic emotions. What they found was that that the medial prefrontal cortex, medial parietal lobes, and select areas of the temporal and visual cortices were activated in all of the different emotional conditions. The amygdala, for example, often described as the brain centre for fear, was also active during movies portraying happiness and disgust. What this data and other imaging studies have shown is that there is no single structure of the brain linked to each of the six basic emotions. Rather, it is the activation of the circuitry between these

structures, in addition to the structures themselves, that is critical for our conscious experience of an emotion (Barrett, 2017; Saarimäki et al., 2016; Touroutoglou, Lindquist, Dickerson, & Barrett, 2015).

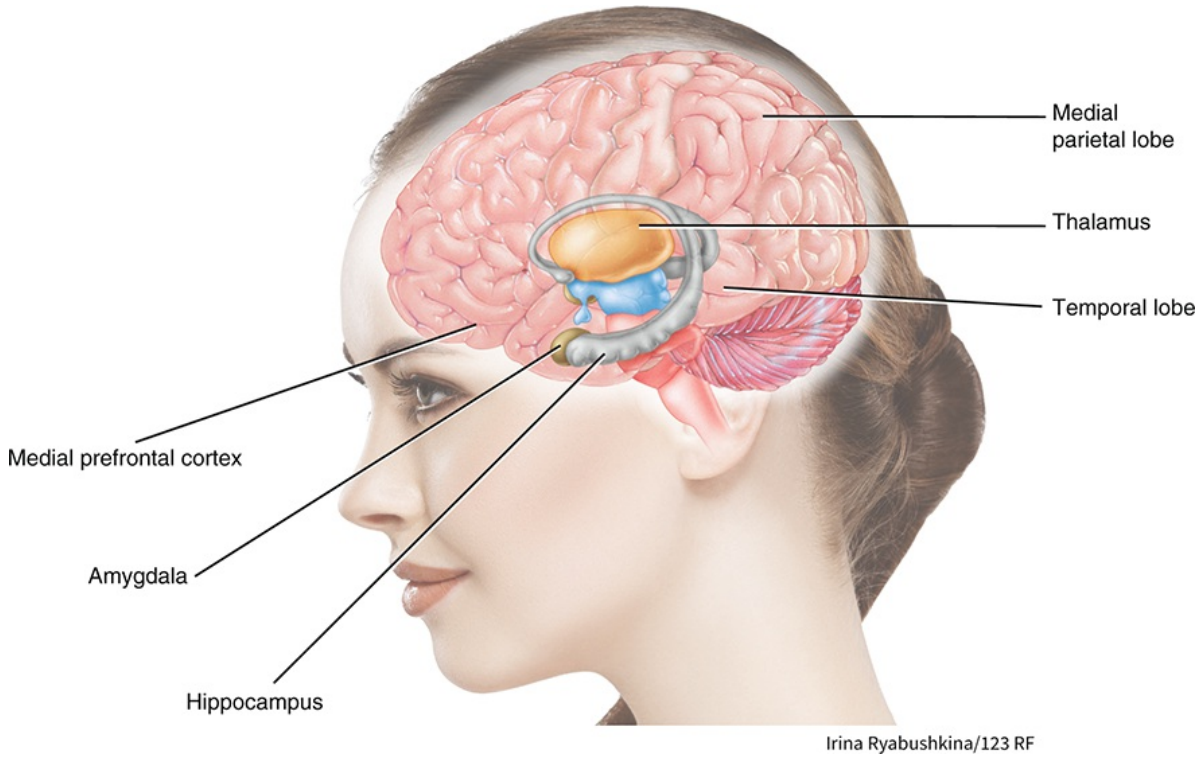


FIGURE 11.15 This figure shows a section of a human brain The medial prefrontal cortex, the medial parietal lobe, temporal lobe, thalamus, hippocampus, and amygdala, and the circuitry between these structures, contribute to our experience of emotions (Saarimäki et al., 2016).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

24. What is the key idea in the James-Lange theory of emotion?

25. What are Cannon's arguments disputing this idea?

26. What element did Schachter and Singer's two-factor theory add to explanations of what determines emotional experience?

27. What is facial efference?

28. What does it mean to say that emotions have been shaped by natural selection?

What Do You Think? • Recall a powerful emotional experience you have had. Which of the theories of emotion detailed in this chapter seems to best explain your experience? Is one theory sufficient?

What About Positive Emotions?

LEARNING OBJECTIVE 8

Identify some factors that influence whether or not a person is happy.

After reading about the work of early emotion researchers, you may think that psychologists have a great deal to say about unpleasant or negative emotions, such as fear, anxiety, anger, and sadness, but less to say about how people experience pleasant, positive emotions, including happiness, pride, and excitement. The past decade, however, has witnessed a striking rise in research on positive emotions, particularly happiness. As you will recall from Chapter 1, a major new trend in the field of psychology is to focus on positive psychology (Seligman & Csikszentmihalyi, 2014; Seligman, 2007; Seligman & Steen, 2005). *Positive psychology* is the study and enhancement of positive feelings, including happiness and optimism; positive traits, such as perseverance and wisdom; positive abilities, such as interpersonal skills; and virtues that enhance the well-being of society, including altruism and tolerance (see photo). Consistent with this important new field of psychology, researchers are now conducting numerous studies on happiness. We have learned that it is indeed one of the most important and adaptive of human emotions.

XiXinXing/Getty Images

Positive psychology **According to positive psychology, positive life experiences play a role in the development of a large range of adaptive qualities such as optimism, perseverance, and wisdom.**

In fact, regarding happiness, the news seems to be quite good. Research indicates that people's lives are, in general, more upbeat than psychologists used to think. In fact, most

people around the world say they are happy—including most of those who are poor, unemployed, elderly, and disabled (Table 11.4) (Graham, 2012; Morgan, Robinson, & Thompson, 2015). Of course, happiness involves different things for different people.

Consider the following results:

Wealthy people appear only slightly happier than those of modest means (Bozionelos & Nikolaou, 2010; Graham, 2012; Jebb, Tay, Diener, & Oishi, 2018).

Although early studies suggested only a minimal relationship between age and happiness (Myers & Diener, 1997; Inglehart, 1990), more recent studies have found that, provided they remain healthy, people over 65 actually report more happiness and less negative emotion than do younger people (Morgan et al., 2015). (See photo.)

Over 90 percent of people with quadriplegia say they are glad to be alive, and overall, people with spinal cord injuries report feeling only slightly less happy than other people (Duggan et al., 2016).

TABLE 11.4

Sample of Happiness Levels Around the World, 2016
Source: Data from Helliwell, John; Layard, Richard; and Sachs, Jeffery (2016). *World Happiness Report 2016*. Sustainable Development Solutions Network, New York, NY. Retrieved from http://worldhappiness.report/wp-content/uploads/sites/2/2016/03/HR-V1_web.pdf

How Much People Enjoy Their Lives as a Whole, on a Scale of 0 to 10			
Denmark	7.5	Belize	6.0
Switzerland	7.5	Japan	5.9
Iceland	7.5	Russia	5.9
Norway	7.5	Poland	5.8
Finland	7.4	South Korea	5.8
Canada	**7.4**	Peru	5.7
Netherlands	7.3	Jamaica	5.5
New Zealand	7.3	Hong Kong	5.5
Australia	7.3	Turkey	5.4
Sweden	7.3	Indonesia	5.3
Israel	7.3	China	5.2
United States	7.1	Morocco	5.2
Costa Rica	7.1	Hungary	5.1
Germany	7.0	Pakistan	5.1
Brazil	7.0	Lebanon	5.1
Belgium	6.9	Portugal	5.1
Ireland	6.9	Vietnam	5.1

Luxembourg	6.9	Greece	5.0
Mexico	6.8	Honduras	4.9
Singapore	6.7	Iran	4.8
United Kingdom	6.7	Bangladesh	4.6
France	6.5	Iraq	4.6
Thailand	6.5	India	4.4
Taiwan	6.4	Egypt	4.4
Spain	6.4	Senegal	4.2
Algeria	6.4	Bulgaria	4.2
Bahrain	6.2	Cambodia	3.9
Venezuela	6.1	Uganda	3.7
Malaysia	6.0	Afghanistan	3.4
Italy	6.0	Syria	3.1

monkeybusinessimages/Getty Images

No age limit People who are happy when younger tend to remain happy as they age. On average, older people are as likely as younger people to be happy, and perhaps more likely.

Men and women are equally likely to declare themselves satisfied or very happy. A longitudinal study published in the journal *Science* found that highly optimistic people had

a 55 percent reduced risk of death from any cause and a 23 percent reduced risk of heart problems, compared with highly pessimistic people (Giltay et al., 2004).

Some studies suggest that one's sense of happiness may have a genetic component (Bartels, 2015; Nes & Røysamb, 2017). Indeed, one of the most dominant factors in determining happiness may be temperament. Twin studies have found that identical twins' ratings of happiness are generally similar (Røysamb, Nes, Czajkowski, & Vassend, 2018), and in classic work by Veenhoven, (1984) it has been reported that the single best predictor of future happiness is past happiness. These findings may suggest that a temperamental predisposition to look at life optimistically is more important than an individual's life situation.

Research also indicates that happiness is linked to our personality characteristics and our typical ways of cognitively interpreting events (Csikszentmihalyi & Wong, 2014; Farah et al., 2014; Diener, Ng, Harter, & Arora, 2010). Recent work from Australia has shown that happy people are, for example, generally optimistic, outgoing, curious, and tender-minded (Soto, 2015). They also tend to possess high self-esteem, be spiritual, be goal directed, and have a sense of perseverance and of control over their lives (Diener, Seligman, Choi, & Oishi, 2018). (See Positive Psychology 11.2.)

11.2 Psychology Around Us | Positive Psychology

Happiness, Motivation, and Psychological Capital

Many college and university students feel stress. Feeling stressed can influence how well we manage the challenges of completing courses and juggling schedules between school and life demands. Having an orientation to happiness is a significant factor in being able to finish post-secondary education. How happy you feel can influence how much you engage in your studies and how motivated you feel to do well in your classes (Durón-Ramos, & García-Vázquez, 2018). Interdependent happiness can also influence how well people feel about themselves and how they do in school. The development of friend groups with other students who can work together to support each other's well-being and happiness can also motivate people to higher academic achievement. The study of interdependent happiness is a new area of psychological research that will be interesting to follow as we learn more about how we all can influence and support the happiness of others (Hitokoto & Uchida, 2015).

Happiness is also a key component of optimism, which fits under the umbrella of a concept often used in the workforce called psychological capital. Four different personal resources fit within the scope of psychological capital: self-efficacy, hope, resilience, and optimism. Having high psychological capital is correlated to higher levels of motivation and academic achievement (Datu, King, & Valdez, 2017, 2018). Increasing your happiness may increase your psychological capital and in turn increase your satisfaction and achievement with your post-secondary experience and ultimately your job. Happiness is a win-win strategy!

Pexels/9148 images/Pixabay

Jumping for joy **Happiness is a key component of optimism and your overall satisfaction with your education, future job, and life in general.**

It appears that good relationships are related to happiness and satisfaction. Married people tend to be happier than single people (although this effect may be stronger for men than for women) (Latif, 2016). Other social predictors of happiness include a society that individuals assess as being prosperous, with adequate food and health care (it isn't always about money), and strong social support networks (Diener & Seligman, 2018; Diener et al., 2018). Some countries, like Bhutan, not only measure their country's wealth, or gross domestic product, as an indicator of a healthy society, they also measure their country's "gross national happiness," which they see as more important than money (Thinley & Hartz-Karp, 2019). And in what may or may not be surprising news to you, college and university students who have close friends and significant others are happier than those who do not (Diener et al., 2018).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

29. Why do some researchers suggest that there may be a genetic component to happiness?

30. What are some of the life circumstances positively related to happiness and satisfaction?

What Do You Think? • How would you advise a friend who asked you for tips on how he or she could be happier?

Summary

Theories of Motivation

LEARNING OBJECTIVE 1 Briefly explain each of the five major theories of motivation.

Several theories offer explanations for our motivation, but no single theory can explain all our behaviour.

Instinct theory, which suggests that environmental cues stimulate inborn behavioural instincts, best explains motivation that serves basic biological drives, such as eating, drinking, and sex.

Drive-reduction theory suggests that internal homeostatic mechanisms produce balance within the body by reducing arousal stemming from unmet basic biological needs.

Arousal theory explains why we sometimes seek to increase arousal levels. The Yerkes-Dodson law proposes that task performance is best if our arousal level matches that needed for a task.

Incentive learning produces extrinsic motivation to engage in experiences that do not fulfill basic biological drives. Primary and secondary incentives may both be involved. Different incentives motivate different people. Incentive motivation involves brain systems associated with pleasure, incentive learning, and the neurochemical opiate dopamine.

Maslow proposed that we are motivated by a hierarchy of needs, in which basic survival needs must be satisfied before higher-level needs for belonging, achievement, and self-actualization.

Biological Motivations: Thirst and Hunger

LEARNING OBJECTIVE 2 Summarize the factors that affect our motivation to drink and to eat.

Thirst is the biological drive to consume fluids. We need fluid inside and outside of our cells to maintain proper cellular functioning. Our bodies our approximately 60 percent water. While it is rare, some individuals can die from water intoxication.

Hunger, our motivation to eat, is created by the interaction of signals from our stomachs, levels of food-related chemicals in our blood, and brain activity, particularly in the hypothalamus.

Culture and individual differences interact with our basic biological need for food to determine what foods we will eat, when and with whom we like to eat, and how much we eat.

Obesity is a major public-health problem in North America. It is usually caused by overeating, which can result from an interaction between genes and the environment.

Anorexia nervosa is an eating disorder in which individuals believe they are fat and eat too little. Bulimia nervosa is an eating disorder in which people binge on food, then purge themselves of the food before it can add weight to their bodies. Binge eating disorder occurs when people gorge themselves on food over repeated sessions.

Biological Motivations: Mate Choice and Sex

LEARNING OBJECTIVE 3 Describe factors that affect our motivation to choose a mate and to have sex.

Several factors influence the people we choose to mate with, including age, body morphology, intelligence, and creativity.

Sexual practices driven by sexual motivation vary widely as a result of cultural influences.

Research consistently shows a great deal of variety in normal sexual behaviour throughout healthy adulthood.

Testosterone and other hormones affect our motivation for sexual behaviour. Many parts of our brains become active during sexual arousal and behaviour.

Psychological Motivations: Individual Factors

LEARNING OBJECTIVE 4 Describe how unconscious/conscious, approach/avoidance, intrinsic/extrinsic, and fixed/growth mindsets affect our motivational drive.

We are all driven by conscious and unconscious processes that influence our motivations to act.

All of us are influenced by internal motivation—doing something because it feels good—and external motivation—gaining a reward for a behaviour. In some cases, individuals are amotivated and do not have a drive to perform even the simplest of behaviours such as getting out of bed.

Approach motivation is the desire to work toward a goal that gives us pleasure versus avoidance motivation where we perform a behaviour to avoid a painful experience.

Growth and fixed mindsets can influence our motivational states.

Psychological Motivations: Affiliation and Achievement

LEARNING OBJECTIVE 5 Describe factors that influence our psychological motivations for affiliation and achievement.

Affiliation represents our need to interact with others, not only for survival, but also for self-worth.

Isolation puts people at risk of psychological impairments.

Self-determination theory suggests that we need competence, relatedness, and autonomy to realize our potential.

Achievement through intrinsic motivation does not involve incentives.

Individuals who are able to delay gratification can focus on goals and ignore distractions.

What Are Emotions?

LEARNING OBJECTIVE 6 Define emotion, types of emotion, and the components,

measurement, and functions of these emotions.

An emotion is an intrapersonal state that occurs in response to an external or internal event and includes three components: a physiological component, a cognitive component, and a behavioural component.

Researchers typically use three kinds of information to measure emotion: behavioural displays of emotion, self-reports of emotion, and physiological reactions.

Emotions serve many functions. They add colour to our lives, give us information about important events in the environment, stir us to action when necessary, and help us to coordinate relationships with others.

Theories of Emotion

LEARNING OBJECTIVE 7 Discuss the major theories of emotion, and identify the pathways through which emotions are experienced according to each theory.

The conventional common-sense explanation of emotion holds that an event triggers an emotion, which leads to physiological changes, followed by a response to the situation.

In contrast, the James-Lange theory proposes that the emotion we feel results from bodily and behavioural responses to environmental stimuli, rather than causing those responses.

According to the Cannon-Bard theory, physiological arousal by itself cannot produce complex emotional experiences. Rather, the perception of an emotionally stirring event simultaneously sends messages to parts of the brain responsible for the subjective experience of emotion and physiological arousal.

Schachter and Singer's two-factor theory holds that an emotional state is a function of both physiological arousal and cognition.

Building on Schachter and Singer's two-factor theory, cognitive-mediational theory proposes that cognitive interpretations, and particularly appraisals, of events are in fact the keys to the experience of emotions.

The facial-feedback theory of emotion, based on the ideas of Darwin, holds that facial expressions that occur in response to stimuli provide feedback to the brain that helps to shape emotional experience.

Evolutionary theorists believe that emotions have been shaped by natural selection and that certain emotions have been passed down because of their role in the survival of our species.

What About Positive Emotions?

LEARNING OBJECTIVE 8 Identify some factors that influence whether or not a person is happy.

Researchers have tended to focus on negative emotions, in part because of difficulties in measuring positive emotions.

Identifying what makes people happy can be difficult. Research has shown that good relationships, employment, and good health are among the things that can make people happy. In particular, though, temperament and personality predict happiness.

Key Terms

affiliation

amotivation

anorexia nervosa

approach motivation

avoidance motivation

basic emotions

binge eating disorder

body mass index (BMI)

body weight set point

bulimia nervosa

Cannon-Bard theory of emotion

cognitive-mediational theory of emotion

conscious motivation

emotion

extrinsic motivation

facial efference

facial-feedback theory of emotion

fixed mindset

grit

growth mindset

hedonic principle

homeostasis

incentives

instincts

intrinsic motivation

James-Lange theory of emotion

lateral hypothalamus (LH)

leptin

loss aversion

motivation

motive

obesity

Schachter and Singer's two-factor theory of emotion

self-determination

unconscious motivation

ventromedial region of the hypothalamus (VMH)

Yerkes-Dodson law

Self-Study Questions

Multiple Choice

1. Which theory of motivation best explains the non–goal-directed behaviours associated with curiosity?

a. Arousal

b. Drive reduction

c. Incentive

d. Instinct

2. The midbrain structure that contains dopamine neurons essential for reinforcement learning, and motivation, is the

a. corpus callosum.

b. hippocampus.

c. nucleus accumbens.

d. ventral tegmental area.

3. What brain structure sends "hunger" signals that cause an animal to eat?

a. Lateral hypothalamus

b. Pons

c. Thalamus

d. Ventromedial hypothalamus

4. Which theory of hunger motivation proposes that activity in the lateral hypothalamus serves to inhibit the ventromedial hypothalamus, and vice versa?

a. Arousal

b. Dual-centre

c. Incentive

d. Instinct

5. Blood levels of what hormone are positively related to sex drive in men?

a. Estrogen

b. Insulin

c. Progesterone

d. Testosterone

6. The psychological characteristic most strongly related to the ability to delay gratification is

a. impulse control.

b. need for achievement.

c. need for affiliation.

d. predestination.

7. The sweaty palms and rapid heartbeat we experience as anxiety are most directly related to activation of which portion of the nervous system?

a. Autonomic nervous system

b. Hippocampus

c. Occipital lobes

d. sympathetic nervous system

8. Which theorist suggested that physiological responses to a stimulus provide the basis for experiencing an emotion?

a. Cannon

b. James

c. Schachter

d. Watson

9. According to the Cannon-Bard theory of emotion, which structure relays information about an emotionally stirring event to the sympathetic nervous system?

a. Anterior cingulate cortex

b. Cerebellum

c. Frontal cortex

d. Thalamus

10. Which statement best describes the difference between the psychological needs for affiliation and for achievement?

a. Achievement is defined in the same way across different societies, but affiliation is

not.

b. Affiliation is a basic psychological need, but achievement is not.

c. Affiliation is less important than achievement.

d. Brain size influences the need for affiliation, but not achievement.

Fill-in-the-Blank

1. Research on arousal and task performance has shown that difficult tasks are best performed under conditions of _____ arousal.

2. The _____ theory of motivation looks to internal and external rewards as motivators of behaviour.

3. Rewarding stimuli often increases levels of the neurotransmitter _____ in the brain.

4. One biological factor related to obesity may be an insensitivity to _____, a protein used by the brain to regulate eating.

5. Masters and Johnson found that men, but not women, have a _____ period after orgasm during which time they cannot have another orgasm.

6. Social exclusion leads to measurable changes in the brain, particularly in the _____ region.

7. Research has shown that _____ motivation is related to beneficial psychological characteristics such as competence and autonomy.

8. A driver who swerves to avoid a crash, then notices that his breathing and heartbeat are rapid, is experiencing the _____ component of emotion.

9. The finding that most people with spinal cord injuries can still experience emotional arousal is supportive of the _____ theory of emotion.

10. Facial _____ refers to the idea that smiling can lead to a happier mood.

CHAPTER 12
Personality

Wavebreak Media ltd/Alamy Stock Photo

CHAPTER OUTLINE

The Psychodynamic Perspective

LEARNING OBJECTIVE 1 Summarize the main ideas of the psychodynamic view of personality development.

The Humanistic Perspective

LEARNING OBJECTIVE 2 Describe the humanistic theories of Abraham Maslow and Carl Rogers.

The Trait Perspective

LEARNING OBJECTIVE 3 Summarize the leading trait theories, and describe how the five-factor theory has evolved from the work of Gordon Allport and Hans Eysenck.

Personality Assessment

LEARNING OBJECTIVE 4 Describe the two major types of personality tests, and give examples of each.

The Situationist and Interactionist Perspectives

LEARNING OBJECTIVE 5 Describe and differentiate the situationist and interactionist views of personality.

Biological Foundations of Personality

LEARNING OBJECTIVE 6 Discuss the heritability of personality traits and some of the neural systems that may be involved in the expression of personality.

Differences in Personality

LEARNING OBJECTIVE 7 Explain how gender and cultural differences can affect personality.

Personality Disorders

LEARNING OBJECTIVE 8 Define personality disorders, and describe some of the key features of these disorders.

Michele Renard is a city girl, raised in the Jewish faith in Montreal. Cécile Corriveau was raised in the Catholic faith in the suburbs. Talking to them as they sit side-by-side in a room on campus, you can tell they grew up in different communities. Dark-haired Michele is dressed in the somber shades of urban chic, while Cécile sports sculpted hair, straightened teeth, and a white fur-lined jacket. Cécile has a car, while Michele does not.

The two students are at neighbouring universities in Montreal, Quebec. They share a birthday, they are exactly the same height, and they both love hip-hop.

The most important thing they share is the same parents. Separated shortly after birth and given up for adoption, for most of their lives they had no idea that somewhere out there was an identical twin.

But they have many similarities in spite of growing up in different homes. They are both night people, they both love to dance, they both want to have a boy and a girl (in that order), and they both use Pantene® shampoo. They are both "B" students, even though Michele attended a top private school and Cécile went to public school. And the subject that gives them both the most trouble? Math. They look remarkably alike, but they are not exactly alike. Michele has a birthmark over her right eyebrow, and Cécile had to wear braces for five years. Plus, Michele says she's a little more outgoing than Cécile, who admits she's a very shy person.

What makes us who we are? How do we explain the striking similarities between Michele and Cécile? Are they an interesting coincidence, or do they reveal something fundamental about the nature of personality?

Personality refers to the ways in which people differ in how they interact with one another socially and in how stable or unstable those characteristics are over time and situations. Personality, along with intelligence, is part of what is called *individual difference psychology*. Efforts to characterize the links between inner experience and outward behaviour go back centuries. Hippocrates (yes, the Hippocratic Oath) identified four distinct personality types: sanguine (into good times), phlegmatic (calm and wise), melancholic (withdrawn and darkly moody), and choleric (quick to anger and fight). The fact that you can probably name people you know that would fit into each of these types suggests that Hippocrates' observations usefully speak to one of two fundamental personality questions: What are the ways, or the dimensions along which, people differ or vary? As we will discuss later in this chapter, you have an implicit personality theory that you use every day to answer this question as you try to understand and predict the social behaviour of people around you and to understand your own behaviour. Like Hippocrates' work, your implicit personality theory is based on your observations and experience and you use it to decide what to expect from the people you know and you use it to make

lightning-fast decisions or first impressions about new people you encounter that determine whether or not you want anything more to do with them. The trait approach and the personality inventories it led to was initially grounded in addressing this first, "what," question.

> **personality** the unique characteristics that account for enduring patterns of inner experience and outward behaviour.

There is, however, a much bigger second personality question that has occupied much theoretic work and research in psychology because it is concerned with the question of "why" or "how" is it that people turn out the way they do? Many theories in psychology have tried to dig in to aspects of the "why" question, including how much of personality might be tied to biological predispositions, temperaments, or instincts, and how much might be explained by life experiences, parenting, education, and other social experiences and how stable or flexible is personality. As we discussed back in Chapter 4, psychologists and biologists have come to acknowledge that environmental experience and biological mechanisms work together to shape personality. In this chapter, we will first explore key historic perspectives on the "why" question in personality: the *psychodynamic, humanistic, trait, situationist*, and *interactionist* perspectives. We then look at the important role played by genetic predispositions in personality and what researchers have discovered about the contributions of both genetic and environmental factors. Next, we examine how personality is assessed in individuals and whether personality differs depending on gender and culture. And finally, we describe various personality disorders.

The Psychodynamic Perspective

LEARNING OBJECTIVE 1

Summarize the main ideas of the psychodynamic view of personality development.

As you read in Chapters 1 and 6, the psychodynamic (or psychoanalytic) model emphasizes the unconscious, often dark desires that have to be held in check. Recall also from those chapters that the model was formulated by the Viennese neurologist Sigmund Freud (1856–1939) at the beginning of the twentieth century. Freud, like his contemporary Charles Darwin (Moncayo, 2018), believed that a full account of human psychology and personality needed to include acknowledgement that humans, like other animals, have some basic wired-in drives of instincts. In Freud's broadly cast efforts to address the "why" question, the personality forms as a result of struggles between primal needs and social or moral restraints. Many other theorists who follow Freud's key principles differ from him in certain ways. However, they share his basic notion that personality and behaviour are shaped by interacting, or *dynamic*, underlying forces. Thus, all such theories, including Freud's, are referred to as *psychodynamic*.

FIGURE 12.1 Freud's view of the mind **According to Freud, the mind has three levels of consciousness. The content stored in the unconscious level is especially important for personality development.**

The Structure of Personality

Central to Freud's ideas are his views of the conscious and unconscious mind. To Freud, the mind is a little like an iceberg. Only the top of the massive entity is visible to the outside world (see **Figure 12.1**). Three levels of consciousness contain the information stored in our minds, but most of that information is not available to normal awareness.

The topmost level is the *conscious* mind, composed of the thoughts and feelings that we are aware of at any given moment.

The second level, just below the surface, is the *preconscious*, which contains thoughts, memories, and ideas that can be easily brought into the conscious mind if attended to. For example, your mother's birthday or your plans for this evening remain in your preconscious until you require the information, at which point the information is transferred into your conscious awareness.

The deepest level, the *unconscious*, contains most of the content of our minds. We are unaware of this content and cannot become aware of it except under special circumstances. The unconscious is particularly important to the development of personality.

Freud identified three central forces in personality development: basic instinctual drives (which he called the *id*), rational thoughts (the *ego*), and moral limits (the *superego*).

The **id** is present at birth and represents basic instinctual needs and desires, such as those related to eating, sleeping, sex, and comfort. These impulses are governed by the *pleasure principle*; that is, they constantly strive for gratification. Freud believed that most of these basic impulses have sexual overtones and that sexual energy, which he called *libido*, fuels

the id. Due to the simple nature of the id's needs and its urgent demand for satisfaction, the id is often described as immature and childlike or essentially mindless. The id resides largely in the unconscious and is not readily available to consciousness.

> **id** according to psychoanalytic theory, the personality element representing basic instinctual drives, such as those related to eating, sleeping, sex, and comfort.

As children grow older, they begin to learn that their id impulses are often not socially appropriate and thus cannot always be satisfied. The **ego** develops as a result of this learning. The ego works under the *reality principle*—the awareness that it is not always possible or acceptable to have all wants and desires met. Much like the id, the ego is responsible for satisfying impulses, but instead of demanding immediate and direct gratification, the ego first assesses what is realistically possible and what the social consequences of gratification might be. Freud essentially saw the ego as the rational, problem-solving force that constantly strives to keep id-based impulses from bursting forth in a destructive manner. From this description, you might conclude that the ego is largely a product of the conscious mind, but Freud believed that it works both consciously and unconsciously.

> **ego** according to psychoanalytic theory, the personality element that works to help satisfy the drives of the id while complying with the constraints placed on behaviour by the environment.

The **superego** also forms during childhood. It is in charge of determining which impulses are acceptable to express openly and which are unacceptable. The superego develops as children observe the behaviours of those around them in their families and their culture. As children, we *internalize*—or unconsciously adopt—the values and norms embodied in those behaviours and begin to evaluate ourselves with respect to them. The superego's standards of right and wrong comprise our moral code and remain stable over the course of our lives. Our superego might therefore be thought of as our *conscience*—an entity that leads us to feel guilt and sometimes even anxiety. Like the ego, the superego resides in both the conscious and the unconscious mind.

> **superego** according to psychoanalytic theory, the personality element in charge of determining which impulses are acceptable to express openly and which are unacceptable; develops as we observe and internalize the behaviours of others in our culture.

According to Freud, the ego acts as a mediator between the id and superego. That is, it balances the powerful desires of the id with the moral standards of the superego. Freud believed that the three forces are always in conflict to some degree. Usually, the conflict takes place at an unconscious level. What if these conflicts are not resolved? Personality problems and even psychological disorders may result if a person is not able to find acceptable compromises.

Freud's Psychosexual Stages

Freud believed that as the id, the ego, and the superego work with and against one another, children move through stages that result in the development of personality. The two drives that influence these stages most strongly are *sexuality* and *aggression*. To Freud, these drives are the most likely to cause internal conflict because they are the ones that most often fall under social and moral constraints and are most likely to be left unsatisfied. Accordingly, the stages of development are termed **psychosexual stages**. Several are named after specific *erogenous zones*, or pleasure-producing areas of the body. As shown in **Table 12.1**, Freud labelled the stages *oral*, *anal*, *phallic*, *latency*, and *genital*.

> **psychosexual stages** according to psychoanalytic theory, stages in the development of personality; the stages—labelled oral, anal, phallic, latency, and genital—are primarily influenced by sexuality and aggression.

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Oral personality in the making? Freud proposed that individuals whose nurturance needs are not adequately met during infancy may become fixated and develop an oral personality style. They may, for example, be inclined to suck their thumbs even during later childhood, chew their nails, smoke cigarettes, and show signs of dependence.

Freud believed that the psychosexual stages function as learning periods that can produce many individual differences in personality. Children must successfully complete, or *resolve*, the issues of each stage to form a healthy personality. As children move into a new stage, they must cope with new demands from the social environment and conflicting internal feelings. If they do not successfully resolve the conflicts that arise, they may become *fixated*, or mentally stuck at that stage of development. Freud hypothesized that a fixation may affect all subsequent development.

Freud linked fixation at different psychosexual stages to the development of distinct, sometimes abnormal, personality characteristics (see photo). For instance, Freud believed that a boy in the phallic stage focuses on his penis and a girl on her lack of a penis (so-called *penis envy*). A boy entering the phallic stage also begins to feel sexual attraction toward his mother and jealous rage toward her love interest, his father. Freud called these feelings the

Oedipus complex, after the character in Greek mythology who inadvertently killed his father and married his mother. At the same time, the boy fears that his father will punish him for his feelings, perhaps by cutting off his source of sexual function, his penis (so-called *castration anxiety*). These feelings, of course, are unconscious, and the child's attempts to resolve the conflicts they create also occur largely at the unconscious level. If children fail to resolve such conflicts, they may suffer from **neuroses**, Freud's term for abnormal behaviour patterns characterized by anxiety, depression, and other such symptoms.

neurosis an abnormal behaviour pattern caused by unresolved conflicts between the id, ego, and superego.

Anxiety and Defence Mechanisms

We have seen that internal psychological conflict, often resulting in anxiety, is central to personality development in psychoanalytic theory. Because humans cannot constantly live in an unsettled state of anxiety, they must have some effective methods for handling it—methods for keeping the id forces in check. This realization forms the basis for one of Freud's major contributions to how human beings think about themselves: **defence mechanisms**. Freud described defence mechanisms as unconscious tactics employed by our egos to protect us from anxiety by dealing with id impulses. **Table 12.2** lists and describes some defence mechanisms.

defence mechanisms unconscious tactics employed by the ego to protect the individual from anxiety.

TABLE 12.1

Freud's Psychosexual Stages

Stage	Erogenous Zone	Key Conflict or Experience	Symptoms of Fixation
Oral (0–18 months)	Mouth	Weaning	Dependency on pleasures of the mouth; also general dependence on mother
Anal (18 months–3 years)	Anus	Toilet training	Excessive neatness, orderliness, stubbornness, stingy, controlling
Phallic (3–6 years)	Genitals	Attraction to opposite-sex parent	Sexual role rigidity or confusion
Latency (6 years–puberty)	None	Repression of sexual impulses; identification with same-sex parent	No fixations for this stage
Genital (puberty–	Genitals	Establishing mature sexual relations and emotional	Sexual dysfunction and unsatisfactory relationships

adult)		intimacy	

Repression is the most basic defence mechanism. This strategy keeps unpleasant memories or thoughts buried deep within our unconscious minds, protecting us from the difficult and painful process of facing them. Another frequently used defence mechanism, and one that has entered into our common vocabulary, is **denial**. This occurs when a person simply refuses to recognize an existing situation. A person who gambles constantly, for example, may claim that she doesn't really gamble that much or that, even if she does, it isn't a problem and she can quit anytime. Denial can also be seen in historic mainstream beliefs regarding retirement of Canada's First Nations People (see Indigenous Experiences 12.1). It's important to remember that, as stated above, defence mechanisms are unconscious tactics. Thus, the gambler in our example is not consciously making excuses for her behaviour when she practises denial. Examples of other defence mechanisms are described in **Table 12.2**.

repression the most basic defence mechanism; the process of keeping unpleasant memories or thoughts buried deep within the unconscious mind.

denial a defence mechanism; the process of refusing to recognize an existing situation.

12.1 Indigenous Experiences

Denying Our Past

Denial is an unconscious defence mechanism used to protect us from uncomfortable truths. Denial has played a significant role in the justification, obfuscation, and rejection of the facts in relation to Canada's colonial history.

Many Canadians see themselves as living in a country of overly apologetic people who are polite, decent people who care about others and have a strong moral centre. But Canada's colonial history stands in sharp contrast to that perception (Stromquist & Knickerbocker, 2015). To this day, denial about the treatment of Indigenous people has taken many forms, such as the following:

> On the heels of his apology to Indigenous leaders and survivors on the floor of the House of Commons in 2008, then-Prime Minister Stephen Harper told those attending the G20 Summit in 2009: "We also have no history of colonialism" (Strakosch, 2015, p. 20).
>
> **Facts:** The Indian Act, residential schools, forced relocation of Indigenous peoples, imposed band council system, outlawing of cultural ceremonies and traditions, and so on. (Strakosch, 2015; Truth and Reconciliation Commission, 2015).
>
> Indigenous children were provided with education and opportunities they would not have received without access to residential schools (Stromquist & Knickerbocker, 2015).
>
> **Facts:** Although some Indigenous survivors report positive experiences in

residential schools, the majority report receiving an inferior education, often educated to only Grade 5, experiences of abuse and neglect, overcrowding, stolen identities, forced manual labour, inadequate nutrition, and deliberate attempts to undermine their languages and cultures. Moreover, many children did not live to talk about their experiences. The National Residential School Student Death Register lists the names of 3200 children who died while in residential schools. However, this number is considered to be low, with closer to 6000 children presumed dead. Many parents never knew what happened to their children. The Missing Children Project is seeking to complete the national register to document the burial places for all of the Indigenous children who never returned home (Truth and Reconciliation Commission, 2015).

Government officials were not aware of the conditions in the residential schools (Stromquist & Knickerbocker, 2015).

Facts: The Canadian government played a central role in the creation and maintenance of the residential school system. The system was underfunded and mismanaged, with tragic consequences. In 1907, Dr. Peter Henderson Bryce, Canada's first Chief Medical Officer, and an expert on tuberculosis (TB), visited 35 residential schools and issued a report condemning the appalling health conditions he encountered there. He argued that TB and other illnesses were responsible for the deaths of 24 percent of children in the residential schools he visited. He recommended solutions and persistently wrote to officials responsible for the schools, demanding action. His position was then abolished. In 1922, upon retirement, he published his findings: *The Story of a National Crime being an Appeal to the Justice of the Indians of Canada* (Milloy, 2017).

THE CANADIAN PRESS/Justin Tang

National Residential School Memorial Register Joyce Hunter and Stephanie Scott, from the National Centre for Truth and Reconciliation, carry a ceremonial cloth depicting the names of 2,800 children who died while in residential schools. Joyce's brother, Charlie Hunter, is among those named. He died at St. Anne's Residential school in 1974.

Until the Truth and Reconciliation report in 2008 and the subsequent government apology, many Canadians did not even know about the existence of residential schools and what occurred there. For many, that is still true today. "This denial [makes] it easy to blame the victims for the inevitable consequences of cultural breakdown, family dysfunction, poverty, addiction, and incarceration" (Stromquist & Knickerbocker, 2015, p. 18).

Critical Thinking Questions

In what ways have Canadians been in denial regarding the experiences of Indigenous children in residential schools?

How is victim-blaming linked to both current general attitudes toward Indigenous people in Canada and non-Indigenous Canadians' limited awareness of the residential school experiences?

What steps might be taken to try and reduce the level and extent of denial within the general Canadian population regarding the residential school experiences of Indigenous Canadians.

TABLE 12.2

Some Common Defence Mechanisms

Mechanism	Description	Example
Repression	Keeping unpleasant memories or thoughts buried in the unconscious	Forgetting the details of a tragic accident
Denial	Refusing to recognize an unpleasant reality	Refusing to admit an addiction: "I don't have a problem" or "The emperor's new clothes are lovely!"
Rationalization	Creating a socially acceptable excuse to justify unacceptable behaviour	Justifying cheating on taxes because "everyone does it"
Reaction formation	Not acknowledging unacceptable impulses and over-emphasizing their opposite	Overpraising a sibling's accomplishment even though you resent his/her success
Projection	Transferring one's unacceptable qualities or impulses to others	Not trusting a co-worker but believing the co-worker does not trust you
Displacement	Diverting one's impulses to a more acceptable target	Yelling at family members after being yelled at by your boss
Sublimation	Channelling socially	Redirecting aggressive behaviour by

	unacceptable impulses into acceptable activities	becoming a professional fighter
Regression	Reverting to immature ways of responding	Throwing a tantrum when frustrated
Identification	Enhancing self-esteem by imagining or forming alliances with others	Joining groups for their prestige value
Intellectualization	Ignoring troubling emotional aspects by focusing on abstract ideas or thoughts	Discussing various economic theories while ignoring the pain of losing your job

Monkeybusinessimages/Dreamstime/GetStock

A guilty conscience Preschool children start to show that they feel guilt when they cause damage or harm.

Evaluating Freud's Theories

The popularity of psychoanalytic theory was at its highest in the mid-twentieth century. Even today, many of Freud's ideas continue to influence the development of the field (Allen, 2015; Dumont, 2010; Colace, 2018; Levin, 2018). However, since the mid-twentieth century, when the popularity of psychoanalytic theory was at its highest, Freud's theories have come under significant criticism in the scientific community. Such criticism is largely due to the fact that the key principles of psychoanalytic theory are based on observations that cannot be directly tested by scientific methods (Zepf, 2018).

Freud based his theories on the cases of patients he treated in his private practice as a neurologist. When presented with puzzling symptoms, Freud pieced together clues from

the patient's childhood to try to identify the cause. For example, one of his patients—a 5-year-old boy called Little Hans—had developed an intense fear of horses (Freud, 1909, 1961). Freud came to believe that the boy's anxiety was a product of his psychosexual development related to his relationship with his father. In a lengthy summary of his treatment of Hans, Freud described his procedure for helping the father and son learn to address the repressed feelings that were leading to Hans's anxiety.

Freud's case studies, such as that of Little Hans, are effective at characterizing and classifying certain types of observed behaviours. Indeed, Freud's theories can provide an explanation for almost any type of observed behaviour (see photo). For example, we might say that a man who keeps getting into fist fights is redirecting angry, unresolved feelings of aggression toward his parents onto his various acquaintances in life. At the same time, we might say that another man, who is unhappy but not hostile, is repressing those same feelings of aggression. In both cases, we have explained the man's behaviour (or non-behaviour). But recall that psychologists seek to predict as well as to describe and explain. Based only on the knowledge that a particular man has unresolved feelings of aggression toward his parents, could we predict whether or not he will be prone to hostile and fighting relationships? Probably not. This lack of predictive power is a key weakness of psychoanalytic theory.

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Jose Luis Pelaez Inc/Blend Images/Getty Images

Setting the stage **Freud was among the first theorists to hold that parent–child relationships influence how people feel about themselves and how they handle intimacy as adults. It is obvious which of the interactions pictured here represents a healthier approach to correcting a child's mistakes, according to Freud.**

Additionally, many of Freud's observations were based on a very small and select population of upper-class individuals from nineteenth-century Vienna. This raises questions about the theory's cross-cultural validity and highlights the fact that Freud's ideas were based on his particular—and at times narrow—views of sexuality and parenting norms, and his especially narrow views of gender roles.

At the same time, Freud's supporters argue that it is unfair to criticize psychoanalytic theory for not holding up to scientific testing when it was never intended to act as a predictive model. Rather, Freud's fundamental claim was that individuals can find meaning from looking into their past (Rieff, 1979).

On the positive side, many general aspects of Freud's theory remain relevant today, such as the idea that our relationships with our parents can influence how we form intimate emotional relationships in adulthood (Briere et al., 2017; Blanchard, Lyons, & Nelson, 2014; Richter, 2013). (See photos.) In addition, some studies on defence mechanisms suggest that they are observable and can have important functions in both development and psychological disorders (Bhatia et al., 2016; Perry & Bond, 2012).

Perhaps most importantly, Freud's ideas spurred the first inquiries into the functioning of the conscious and unconscious aspects of the mind and how they relate to behaviour. The study of the unconscious mind has accelerated in the last two decades (Kihlstrom, 2019). As you learned in Chapters 6 and 8, numerous studies indicate that much of the information processed by the mind remains unconscious, and people rely on a variety of automatic processes to function in the world.

Other Psychodynamic Theories

Over time, some of Freud's followers, disagreeing with aspects of Freud's theory, split away to form their own schools of thought, becoming what are called *neo-Freudians*. Three of Freud's most notable followers were Alfred Adler, Carl G. Jung, and Karen Horney. The theories of the neo-Freudians departed from Freud's in important ways. But, as you read earlier, each held on to Freud's basic belief that human functioning is shaped by interacting, or *dynamic*, psychological forces.

Anna Peisl/Corbis/Getty Images

Moving beyond inferiority **Adler proposed that a child's inevitable experiences of helplessness produce early feelings of inferiority, which can lead to a lifelong sense of inferiority or to a lifelong quest for completeness and superiority.**

Alfred Adler

Alfred Adler (1870–1937) believed that social needs and conscious thoughts are more important to human behaviour than sexual needs and other unconscious motivations. Adler was particularly interested in how feelings of *inferiority* motivate behaviour. In Adler's view, almost everyone has some feelings of inferiority stemming from childhood experiences of helplessness (see photo). People often make special efforts to compensate

for or mask those painful feelings. Adler focused, in particular, on how feelings of inferiority are channelled into a quest for superiority. Although Adler's school of *individual psychology* has not had a major impact on personality theory, his ideas about how the need for power shapes human behaviour have gained momentum in contemporary research (Miller & Dillman Taylor, 2016; Maniacci, Carlson, & Sackett-Maniacci, 2017).

Carl Jung

Unlike Adler, Carl G. Jung (1875–1961) agreed with Freud's views on the importance of the unconscious. However, he added a new dimension: the collective unconscious. In Jung's system, the unconscious has two parts. The *personal unconscious*, formed from individual experiences, is similar to the unconscious as seen by Freud. The *collective unconscious*, however, is not a private entity like the personal unconscious. Instead, it is a cumulative storehouse of inherited memories shared by all humankind. Jung called these shared memories *archetypes*. According to Jung, archetypes are reflected in symbols and images that appear in the art, literature, and religions of all cultures. The archetype of the hero, for example, can be found in the stories of almost any cultural tradition, while an archetype of mother and stepmother can be seen throughout children's fairy tales (Garry, 2017).

Michael Macor/San Francisco Chronicle/Polaris Images

The positive drives of personality **Artist Frances Dunham Catlett (1908–2014) speaks about her work at a reception celebrating her "century of creativity." Carl Jung believed that unconscious drives toward joy and creativity are powerful forces in personality.**

Jung's *analytical psychology* also differed from psychoanalytic theory in the emphasis placed on sexuality and aggression. Jung acknowledged the importance of these forces, but argued that the unconscious also includes drives toward joy, creativity, and internal harmony (Wilde, 2011). (See photo.) Indeed, the search for harmony is a central theme of Jung's theory (Schmidt, 2019). He believed that each of us seeks to integrate the mind's various conscious and unconscious elements into a coherent whole, which he termed the *self* (see Practically Speaking 12.1).

Karen Horney

Another neo-Freudian, Karen Horney (pronounced HORN-eye) (1885–1952), accepted many of the basic principles of psychoanalysis, but went on to develop her own orientation and school of psychoanalytic training. Horney agreed with Freud that anxiety-provoking experiences in childhood can lead to lasting psychological problems, but she was particularly interested in what she called *basic anxiety*, which develops in children who experience extreme feelings of isolation and helplessness. Basic anxiety, in Horney's view, sets the stage for later neuroses.

Perhaps Horney's greatest disagreement with Freud related to the role of cultural influences on behaviour. To Freud, the basic conflicts that shape development are universal, but Horney observed distinct differences in personality structure between patients from Europe and those from the United States. She came to believe that cultural differences play a more important role in development than traditional psychoanalytic theory acknowledged. Horney rejected Freud's theories about penis envy, suggesting that what Freud was really detecting was women's envy of men's power—power that came from cultural norms, not inherent differences (Forsythe, 2019).

12.1 Practically Speaking

Jung in the Business World

In the 1940s, a mother–daughter team, Katharine Cook Briggs and Isabel Briggs Myers, created the Myers-Briggs Type Indicator (MBTI). Today it is one of the most well-known personality tests. Employers in various job fields, employment agencies, and job counsellors administer the questionnaire to several million individuals each year, though it is not appropriate for use in hiring decisions (Emre, 2018; Youngman, 2017; Wilde, 2011). The test is popular because it describes how we interact with our environment as well as with other people and can help us to see ways in which people can be different without being better or worse than others. This knowledge can be extremely useful for a manager in charge of a team of employees (and for the employees themselves) from diverse backgrounds, for example. As well, it can be very helpful for individuals in organizational settings to help them figure out why their interactions with their co-workers typically go the way they do.

The MBTI is based on Carl Jung's theory of personality types, and it describes personality in terms of individual preferences for perceiving and judging the world (Emre, 2018; Montequin et al., 2013). Do you prefer a more social or solitary environment? How do you interpret the information you take in? When you make a decision, do you first think about it logically or emotionally? Are you open to several possibilities? Your answers describe your basic preferences and, theoretically, reveal a lot about the kinds of jobs you would most enjoy (Wilde, 2011; Myers et al., 1998). Knowing your preferences may also provide clues about your strengths and weaknesses at work. One thing the MBTI cannot inform you or a prospective employer about is your abilities (McCrae & Costa, 1989); it cannot tell you how well you will perform a particular job and as such it should not be used in hiring decisions.

Most psychologists warn against basing career decisions only on the MBTI (Weber,

2015). Although the test may inform you that you meet the criteria of an introverted type, this does not mean that you should avoid that sales job you were coveting. Your categorization as an introvert does not mean that you are totally lacking in extroversion qualities, nor does it mean that you cannot behave in an extroverted manner when the social/work situation calls for it. Moreover, success at the job depends on many variables beyond extroversion or other such personality traits. And finally, for most jobs, a variety of different approaches can lead to success.

efenzi/Getty Images

Recall earlier discussions about the difference between correlation and causation. Remember that *correlation does not imply causation*; that is, simply because variables are correlated does not mean that one of the variables *causes* the other. So even though you may have a number of characteristics that indicate you might be an introvert, this does not mean that these characteristics will cause you to succeed in one line of work over another; these characteristics simply tell us that, in general, introverts excel in certain types of jobs.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

1. In Freudian theory, how does a neurotic personality develop?

2. What is repression?

3. What are some common criticisms of psychoanalytic theory?

4. How did Jung's idea of the unconscious differ from Freud's?

What Do You Think? • Why do you think the concept of defence mechanisms has been embraced by so many theorists (even those who are not psychodynamic) and by the public?

The Humanistic Perspective

LEARNING OBJECTIVE 2

Describe the humanistic theories of Abraham Maslow and Carl Rogers.

Psychodynamic theorists, particularly Freud, generally believe that personality development is driven by deep instinctual forces that are largely beyond our control. Humanistic psychologists offer a different view. As you first saw in Chapter 1, they emphasize people's potential and highlight each person's consciousness, free will, and other special human qualities. Let's consider the ideas of two key humanistic theorists: Abraham Maslow (1908–1970) and Carl Rogers (1902–1987).

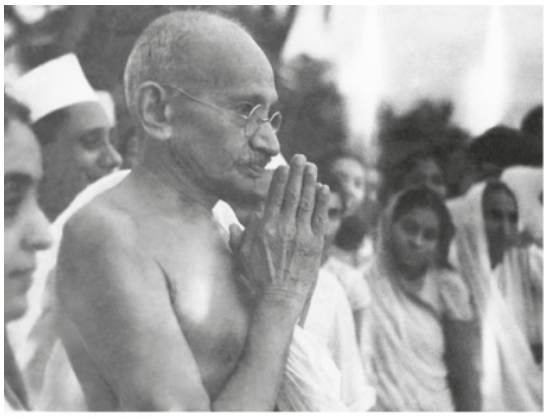
Abraham Maslow

Chapter 1 pointed out that Abraham Maslow believed humans are basically good. In each of us, according to Maslow, is an urge to grow and fulfill our potential. Personality arises from people's striving to meet their needs (D'Souza & Gurin, 2016). As you saw in Chapters 1 and 11, these needs are arranged hierarchically, beginning with the need for basic physiological necessities, such as food and shelter, and becoming increasingly complex. Only after our basic needs have been met can we address more subtle needs and strive to attain more complex things. Our highest-level need is **self-actualization**—the need to fulfill our full and special potential as human beings. Maslow described self-actualization as "the full use and exploitation of talents, capacities, [and] potentialities" (1970, p. 150). He suggested that psychologists had become overly focused on biological drives and needs, overlooking the role of high-level processes and the need for more complex forms of fulfillment.

> **self-actualization** the need of humans to fulfill their full and special potential; the highest level of need in Maslow's hierarchy of needs.

Unlike Freud, Maslow believed that more could be learned from individuals who were healthy and well-adjusted than from those who were experiencing psychological problems. In fact, he based his notion of self-actualized individuals on notable historical figures who appeared to lead rich and healthy lives: Albert Einstein and Eleanor Roosevelt, for example (Peterson, Park, & Seligman, 2013; Peterson & Park, 2010). The characteristics that define self-actualized people are the ability to recognize the needs and desires of others, the

willingness to respond to the uniqueness of people and situations rather than responding in mechanical or fixed ways, an emotionally deep connection with a few people, spontaneity and creativity, and the ability to resist the urge to conform while still responding to reality (see photos). In First Nations communities Elders are given significant respect and standing for the wisdom they have accumulated over their lives (see Indigenous Experiences 12.2).



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Candidates for self-actualization **Maslow proposed that self-actualized people also recognize the needs of others and seek to address them. He believed that full self-actualization was rare. However, well-known people like Bill Gates, Bono, and Gandhi are considered to be self-actualized because of their worldwide humanitarian undertakings. However, it is important to note that many people who recognize and seek the needs of others are not self-actualized; consider the case of the volunteer hospice worker who gives selflessly of her time and energy simply to help others.**

Some of Maslow's ideas have been taken up by psychologist (Mihaly Csikszentmihalyi 2020; Mao et al., 2016). Csikszentmihalyi studied *peak experiences*—moments in which people experience intense clarity of perception, feelings of joy and excitement, and a suspended sense of time and reality. Maslow thought that such moments usually occur when a person becomes totally engrossed in an activity, such as when we hear a beautiful piece of music or experience the beauty of nature. Csikszentmihalyi's writings on peak experiences reflect psychologists' growing interest in **positive psychology**, the study of positive experiences and healthy mental functioning involving things like simple acts of kindness (see Positive Psychology 12.1) and other things that we discussed in Chapter 11 (Lopez, Pedrotti, & Snyder, 2018; Seligman, 2019).

positive psychology an area of psychology focusing on positive experiences and healthy mental functioning.

12.2 Indigenous Experiences

Wise Elders as Knowledge Keepers and Transmitters

Elders have long been considered knowledge-keepers and transmitters of Indigenous spirituality, wisdom, and history, and in this role, they are vital to transmitting cultural and spiritual traditions and practices (Smylie et al., 2014). Elders play a key role because they are recognized as having earned the right to teach and to provide guidance and advice to individuals and to the larger community. Although the specifics of the role vary from one community to another, Elders all serve as role models for traditional practices and share a deep spirituality embodied in their lives and reflected through the harmony and balance of their actions (Rowe et al., 2020). Elders teach in their communities about history, language, and cultural knowledge as it has been historically handed down in spiritual ceremonies and oral traditions.

Being an elder is not defined by age or by gender. Elders are not all old and not all old people are Elders. Instead, Elders are chosen by their communities based on their life experiences, wisdom, and leadership. Many Elders have experienced adversity; some have experienced family separation, drug or alcohol addiction, survived residential schooling, and others have experienced different struggles. But an Elder has learned from the experiences of their life, turned to traditional culture for support and healing, and is committed to helping others. Elders believe in and teach respect for the natural world and the interconnectedness of all things (Smylie, Olding, & Ziegler, 2014). Survivor Isabelle Knockwood grew up in the Mi'kmaw community in Nova Scotia. She was taught to respect Elders. "They knew the seasonal cycles of edible and medicinal plants, and the migrations of animals, birds and fish, and they knew which hunting and trapping methods worked best with certain weather conditions" (Truth and Reconciliation Commission, 2012, p.8).

Since many Indigenous communities are currently experiencing an interruption in the intergenerational circle as young people increasingly reject their roots (Rowe et al., 2020), the "importance of preserving Elders' wisdom and sharing cultural knowledge and oral traditions across generations" is key (Freeman et al., 2020, p. 284). Residential schools damaged multiple generations, leaving each generation with unhealed trauma. "As a result, each generation of returning children had fewer and fewer resources upon which to draw" (Truth and Reconciliation Commission, 2012, p. 77). For example, Pierre Papatie said that in residential schools, he learned colonized versions of history and the textbooks contained "images that were telling us that, that the Elders were, savages who massacred missionaries. It was written in, it was in all, we were seeing that in the images in the history of Canada. That's what hurt me. That's what made me hate my father, even my father. Even all the Natives, I hated them all" (Papatie, 2012, p. 124–125).

Boomer Jerritt/All Canada Photos

Knowledge-keeper and transmitter Elder Evelyn Windsor poses for a portrait in Oweekeno, British Columbia.

To counter this intergenerational break, Anishinaabe scholar and activist Leanne Simpson worries that "reconciliation subjugates treaty and nation-based participation by locking our Elders—the ones [who] suffered the most directly at the hands of the residential school system—into a position of victimhood. Of course, they are anything but victims. They are our strongest visionaries, and they inspire us to vision alternative futures" (Simpson, 2011, p. 22.).

Critical Thinking Questions

"Elders are chosen by their communities based on their life experiences, wisdom, and leadership." How does this statement relate to the concept of self-actualization as presented in the chapter?

What important roles do Elders play in the culture of their communities?

Looking forward into the future, what steps should be taken or supported to ensure that cultural continuity provided within Indigenous communities by Elders continues?

12.1 Psychology Around Us | Positive Psychology

Random Acts of Kindness

It is likely that all of you have heard about the idea of random acts of kindness; maybe you've even done one of these for someone else. These acts can range from buying

someone's meal at a restaurant, offering your seat on a subway to someone who is elderly, saying a heartfelt thank you to someone who has gone out of their way to help you, or just picking up garbage in a local park. Learning to do random acts of kindness, and the co-development of compassion for others and our environment, may be of particular use to individuals who score low on agreeableness on the Big Five Personality Trait Inventory.

The personality dimension of low agreeableness is often associated with a tendency to engage in conflict, unfriendly behaviour, and at times overt hostility. In a recent study by Mongrain and colleagues (2018), they tested whether individuals with the personality trait of low agreeableness would benefit from completing acts of kindness toward others. This online study assigned participants who had scored low on agreeableness using the Big Five Personality Trait Inventory (John & Srivastava, 1999) to complete one of three tasks: a control condition where they were asked to journal daily about their interpersonal relationships, a compassion exercise that involved a loving-kindness meditation, and a condition where they had to perform acts of kindness. They did these activities every other day for three weeks. The researchers found that the loving-kindness meditation and acts of kindness reduced depression scores in both groups compared with the control group. What was even more interesting is that those individuals who were low in agreeableness and did the acts of kindness compassion intervention reported increases in life satisfaction, even two months after the study concluded (Mongrain, Barnes, Barnhart, & Zalan, 2018)! To add support to these findings, a recent meta-analysis showed that random acts of kindness could improve how we feel about ourselves (Curry et al., 2018). While this is only one study looking at the effects of acts of kindness on people with low agreeableness, it is an interesting finding that is worthy of follow-up study.

Ariel Skelley/Blend Images/Getty Images

Simple acts of kindness **A simple gesture of giving can provide positive benefits to both the recipient and the giver.**

Carl Rogers

Carl Rogers, like Maslow, believed that human nature is fundamentally positive and that people strive for self-actualization (Rogers, 2008, 1963). However, Rogers based his theory of personality around the concept of the *self* rather than around a hierarchy of needs. For Rogers, **self-concept** is a pattern of perception that remains consistent over time and can be used to characterize an individual. Our self-concept is related both to how we see ourselves and to how others see us. Because self-concept develops in part based on how we are perceived by others, as children we need **unconditional positive regard**—acceptance without terms or conditions—from parents or other adults to develop healthy self-concepts.

self-concept a pattern of self-perception that remains consistent over time and can be used to characterize an individual.

unconditional positive regard acceptance without terms or conditions.

The idea of unconditional positive regard became a central part of Rogers's therapeutic practice. He believed that, over the course of development, many children form *conditions of worth*, a perception that they must meet certain standards to gain the love of their parents or other important figures. These conditions of worth, often rigid or harsh in nature, can hold over into adulthood and act as a negative force that prevents a person from reaching his full potential. The implications for therapy are clear. In Rogers's *client-centred therapy*, discussed in Chapter 1, he worked with clients to create an atmosphere of openness, honesty, and absence of judgment, regardless of the specific type of psychological problems the persons were experiencing. He believed that only in such an atmosphere can individuals begin to put aside the conditions of worth that lie at the root of their personal maladaptive functioning (Zuroff et al., 2016; Rogers, 1995).

Evaluating Humanistic Theories

Many critics fault the humanistic theories for their overly positive focus, saying that they are simplistic and that they ignore the role of psychological dysfunction in society. In addition, it has been difficult for researchers to conduct controlled studies on such abstract concepts as self-actualization and unconditional positive regard (Krems, Kenrick, & Neel, 2017; Farber, Suzuki, & Lynch, 2018). However, humanistic theories have had a pervasive influence on the field of psychology. As mentioned above, and elsewhere in the textbook, researchers in positive psychology are giving new attention to questions about how human beings can achieve their full potential for happiness. It remains to be seen how humanistic psychology will contribute to this ongoing discussion.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

5. What is self-actualization?

6. According to Rogers, what happens if children fail to regularly receive unconditional

positive regard?

7. What is a key criticism of humanistic theory?

What Do You Think? • What do you think are the key qualities of a fully self-actualized person? Who might match your characterization?

The Trait Perspective

LEARNING OBJECTIVE 3

Summarize the leading trait theories, and describe how the five-factor theory has evolved from the work of Gordon Allport and Hans Eysenck.

The units or building blocks that personality psychologists use to describe personalities are called traits. On one level, traits are simply terms (adjectives) used to describe people. Table 12.3 contains some examples of personality trait terms. From the list, see if you can find *one* word that *best* describes who you are, over a wide variety of situations. Chances are good that you know people who provide examples of each of these traits. **Personality traits** are stable characteristics or qualities that people show in a variety of situations over a long period of time, even a lifetime. They describe our tendencies to act in a particular way.

personality traits tendencies to behave in certain ways that remain relatively constant across situations.

TABLE 12.3

Which Trait Best Describes You?
Source: Adapted from Waugh, M. H., Hopwood, C. J., Krueger, R. F., Morey, L. C., Pincus, A. L., & Wright, A. G. (2017). Psychological assessment with the DSM–5 Alternative Model for Personality Disorders: Tradition and innovation. *Professional Psychology: Research and Practice*, *48*(2), 79.

Friendly	Kind
Self-confident	Undemanding
Tricky	Introverted
Unsympathetic	Iron-hearted
Distant	Crafty
Meek	Firm
Unargumentative	Outgoing
Tender	Nervous

Curious	Shy
Calm	Unsophisticated

The area within personality psychology that focuses on traits is called, not surprisingly, the trait approach. Trait researchers are interested in cataloguing traits and determining how many are needed for an adequate picture of human diversity. From this point of view, the traits that individuals possess (how many and to what degree) determine their personality. Thus, personality traits are said to be *dimensional*. This means that trait terms define spectrums that traits can be found along, ranging from people displaying very little to a lot of trait-consistent behaviour. Most traits don't emerge full-blown—they develop gradually over time. Some personality psychologists believe personality is not completely formed, or crystallized, until the late teens all the way to the early thirties, depending on an individual's experiences (McAdams, Shiner, & Tackett, 2018; Wolff, 2017). But this doesn't mean that traits are necessarily carved in stone. We all have the ability to modulate or change our behaviours over time. This may be difficult in extreme cases, but, for instance, very shy people can greatly reduce their shy behaviour, and vice versa (Zimbardo, 2018; Zimbardo & Radl, 1999). However, drastic changes may come at a cost. Shy people who act in an outgoing, extroverted way may have to decompress afterwards by finding some time alone (Little, 2015, 2008). A small price to pay, perhaps, for behaviour that people find rewarding in the long run. It was Socrates who said, "Know thyself." But how? Personality assessment techniques can provide us with some answers to this important question and we will have a detailed look at them a bit later in this chapter but first we will look the related question of how many traits a trait theory needs in order to properly describe and predict social behaviour.

Personality Traits: How Many Do We Need?

All modern, scientific inventories of personality are based on a trait model, The most widely used one today has five trait dimensions and, no surprise, is called the five-factor model (FFM) and will be discussed in detail in the section of Personality Assessment. Even the very first personality tests from as far back as the ancient Greeks were based on some trait theory or model. A **personality trait model** is a mini-theory about the structure of personality traits. It provides answers to questions such as, "How many traits and which ones?" As the name suggests, the FFM resolves these questions with the magic number "5." With all the attention the FFM has received, you might think it was the only one in use, but this is not the case. It *is* true, however, that the Big Five (yet another FFM name) has had a *big* impact on all of personality psychology and beyond, into clinical, social, and business areas of psychology (Seibert & DeGeest, 2017; Feher & Vernon, 2020). This is because it overlaps with many of the other trait models in use and thus has become a kind of unifying standard or benchmark for the field. Where did it come from? Are there other important models?

> **personality trait model** a mini-theory about the structure of personality traits.

Like all good psychological theories and models, the FFM has a long and storied history behind it. The FFM evolved out of a three-trait model, which in turn grew out of a 16-trait

model. And how many traits were there to begin with? Would you believe 27,000! It's not only interesting to see where they all came from but also to see how that huge pool of traits was reduced to something manageable and useful, like five, or even two or three.

It was a Harvard personality psychologist named Gordon Allport (1897–1967), back in the 1930s, who first got the ball rolling in the FFM direction. Rather than have one or two psychologists engage in "armchair theorizing" to come up with a pool of traits, as was common at the time, Allport had another idea about where to find them. He started with a full-sized (unabridged) dictionary. His idea, which we now call the **lexical hypothesis**, was that all the important (and not so important) ways that people can differ have already been encoded in our language and should be available from a comprehensive dictionary. So, with an open *Webster's New* (1924) *International Dictionary* taking up practically his whole desk, Allport began his painstaking search for unique trait terms. In his words, he was looking for terms that could "distinguish the behavior of one human being from that of another" (Allport & Odbert, 1936, p. 24). When the task was complete, close to 18,000 trait terms had emerged from Webster's dictionary, and by the late 1960s other researchers had brought that total to 27,000 (Allport, 1966). After removing unused (archaic) and derivative traits, the total shrunk to about 10,000. But still a long way to go to get down to five! What was needed was a statistical technique to help sort all of these traits into meaningful categories, and a powerful computer to do the calculations. Although data reduction statistical methods, along with mainframe computers, were under development in the 1930s, they remained primitive and impractical for a long time.

> **lexical hypothesis** the idea that our language contains the important ways in which people can differ.

Researchers had to wait almost a couple of decades to reach and jump the next hurdle along the road to the FFM. In 1952, a personality psychologist named Raymond Cattell published a book (Cattell, 1952) on a statistical technique called factor analysis (FA). FA is a mathematical procedure that allows the user to reduce a large number of variables, say, 10,000 trait words, into a manageable few. It is based on calculations of the *intercorrelations* among the trait words. The goal is simplification—to reduce a large set of traits into a small number of clusters, called *factors*. Similarity among traits is determined by the interrelationships that are revealed through their pattern of correlations. Highly positively correlated clusters of traits are lumped together into factors. Ideally, you would be left with a small set of factors that can be used to represent all the rest. For example, if people who rate themselves as, say, *friendly* also tend to rate themselves as *outgoing* and *cheerful*, perhaps a term like *extroversion* can be used in their place. High intercorrelations among a group of traits indicate they are all really tapping different parts of the same thing. What is this *thing*? In this case the point is that maybe all of these traits can best be subsumed under the heading of *extroversion*, which brings together the more specific personality descriptors that can be used to help define it. Factor analysis can also be used to help answer the question: Which of friendly, outgoing, *and* cheerful is more important in defining extroversion*?* It may be that friendliness is closer to the core of extroversion than cheerfulness. That is another empirical question that factor analysis can help answer.

Cattell used his factor analysis tool to reduce the 10,000 traits he found in his dictionary to

just 16 traits. Now that is data reduction! The factor analysis tool seemed invincible. Armed with his 16 traits (which he called source traits, because they were the source of all the other traits), like *dominant*, *trusting*, and *relaxed*, Cattell developed a questionnaire and set out to assess the world (Cattell & Mead, 2008). (See photo.) The questionnaire was appropriately named the 16 Personality Factors inventory (16PF) and has been widely used from its inception, but it is not without its critics. The major problem they point to is the fact that the 16 source factors are more intercorrelated (overlapping) than they should be (Bahner & Clark, 2020; Matthews, 1989). When factors such as source traits overlap, this suggests that one or more is unnecessary and thus could be dropped or folded in with another trait.

Baerbel Schmidt/Getty Images

Spotting the source traits **The fundamental dimensions of personality cited in the five-factor model and other theories of personality including the 16PF are each on display in this photo of people passing through an airport waiting area. Can you identify examples of these key trait categories?**

Evidence for trait overlap in the 16PF led one researcher, Hans Eysenck (1916–1997), to take another look at the inventory. His factor analysis, employing newer techniques designed to reduce overlap, yielded three independent (non-overlapping) **superfactors**: *extroversion* (sociable), *neuroticism* (worried), and *psychoticism* (nasty). Eysenck referred to them as *primary* dimensions of personality (Eysenck, 1973; Revelle, 2016). Drawing an analogy to primary colours and how they can be used to recreate all possible colours, he argued primary traits could be used to account for all possible traits (see **Figure 12.2**). Eysenck proposed a biological explanation for the importance and functioning of his

primary traits, which we will return to in a later section. Not everyone agrees, however, with Eysenck's choice of "primary" traits. Some researchers (e.g., Costa & McCrae, 2017, 1986) took issue with Eysenck's use of psychoticism, because psychoticism test items (e.g., "likes to tease puppies") thankfully do not apply to many people in the population. Positive Psychologists have actually shown, though, that training people to find opportunities for humour can reduce these sorts of negative personality tendencies (see Positive Psychology 12.2). Nonetheless, Eysenck's model has been one of the most researched in the history of modern personality psychology (especially the variety of *extroversion* he proposed) and is closely aligned with the Big Five model. In fact, the first marketed Big Five instrument, called the NEO, was designed to correct the "psychoticism problem" of Eysenck's model (Costa Jr. & McCrae, 2017). If you are getting the impression that factor analysis isn't quite the objective technique you initially thought it was, you would be right. Debates about its use continue (Prudon, 2015; Kline, 2014).

> **superfactor** a fundamental dimension of personality made up of a related cluster of personality traits.

Another technical issue in the literature has to do with whether three factors are enough. The jump down from 16 to three factors was viewed as an extreme move by some (Friedman & Schustack, 2016; Schultz & Schultz, 2016; Wiggins & Trapnell, 1996), and one not justified by most factor analytic studies. Too much trait information was lost in the translation, it was argued, and if psychoticism were dropped (as most agreed it should), this would only make matters worse through oversimplification. Although the debate may now be all but over, it is interesting to note the family resemblance between Eysenck's model and the Big Five. Two of Eysenck's three traits are there in name (extroversion and neuroticism) and psychoticism, the nastiness trait, may be viewed as just an extreme reversal of the agreeableness trait (Lopez et al., 2020; Heaven et al., 2013).

As often happens in polarized debate, a solution lies somewhere in the middle. After many decades of fine-tuning the factor analytic approach, many researchers have now agreed that the number five, if not magical, seems optimal in this case. What convinced many was the fact that people's ratings on hundreds of traits collected in many parts of the world, regardless of the language used, yielded the same five basic dimensions. It strongly appeared that a universal structure of personality had been found (McCrae, 2017). Some researchers, such as Kiboem Lee at the University of Calgary, argue that at least one more factor is needed to account for the variations in human personality. Lee and his collaborator Michael Ashton argue for considering honesty and humility as related and important aspects of personality and social functioning (Lee & Ashton, 2013). Although some theorists argue that factors should be added to the list of five, a great many researchers believe that individual differences in personality can indeed be captured by the five broad categories of this theory (Widiger, 2017; McCrae & Costa, 2003). Because of the theory's popularity with researchers, a significant body of relevant research has accumulated (Zuckerman, 2012, 2011; Widiger, 2017). Five may be the universal number when referring to cross-cultural consistency in personality dimensions, but models with fewer (or more) than five basic dimensions can still be very useful. Moreover, having only two or three factors in a model does not mean you are limited to talking about only two or three traits.

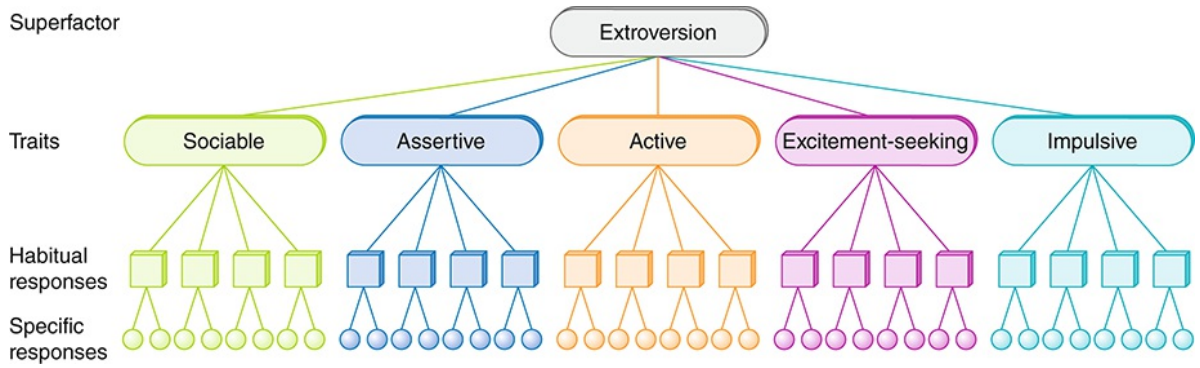


FIGURE 12.2 Eysenck's model of personality **Eysenck used factor analysis to identify traits that cluster together. He described three basic trait clusters, which he called superfactors. Each superfactor, such as extroversion shown here, is made up of specific traits, and in turn each trait is made up of habitual and specific responses.**

Source: Adapted with permission from Eysenck, H. J. (1976). *The biological basis of personality*, p. 36. Courtesy of Charles C Thomas Publisher, Ltd., Springfield, Illinois; based on Weiten, W. (2007). *Psychology: Themes and variations* (7th ed.). Belmont, CA: Thomson Wadsworth.

12.2 Psychology Around Us | Positive Psychology

Personality Traits and Humour Training

Humour training is one of the hot new topics in positive psychology. Incorporating humour into our lives can give us a much-needed break from stress, and some studies have shown it can even help us learn (McCabe, Sprute, & Underdown, 2017). Humour training has been used to minimize the effects of mild depression and enhance happiness. It has been shown to enhance subjective well-being and overall health (Ruch & McGhee, 2014). A recent study has shown a positive relationship between humour and our ability to deal with the negative effects of making mistakes in life (Fischer, Carow, & Eger, 2020). This study found that using humour when dealing with or handling mistakes positively affected the health and well-being of the study's subjects. One question that has only recently been addressed by scientists, however, is whether a person's personality matters when it comes to the effectiveness of humour training.

Wellenzohn & colleagues (2018) gave subjects a set of humorous interventions and assessed whether changes in their scores for happiness increased and depression decreased. The novelty of their study was that the researchers also examined their participants' self ratings of the neurotic, extroverted, and psychotic aspects of their personality. What they found was that those with an extroverted personality type benefited the most from humour training when it came to changing their happiness. So, while humour training may benefit all of us, if you're an extrovert it may definitely be in your best interest to keep a bit of humour in your life.

Rawpixel.com/Shutterstock.com

The positive effects of humour **Humour training helps to increase everyone's levels of happiness but improves that of extroverts the most.**

Consider the model shown in **Figure 12.3**, called the **interpersonal circle**, conceptualized by Timothy Leary and developed by Jerry Wiggins at the University of British Columbia and Ross Broughton and Paul Trapnell at the University of Winnipeg. Here we find what appears to be another 16-trait model, with the traits arranged on the periphery of a circle. The traits are of a particular variety, called *interpersonal* traits, which have to do with things people do when interacting with others, like being shy or dominant. All of these interpersonal traits can be generated by the two primary dimensions labelled *nurturance* and *dominance*, on the *X* and *Y* axes in the figure, respectively. For example, *extroverted* can be viewed as a blend of high nurturance and high dominance (because you have to have high coordinates on the *X* and *Y* axes to get to the spot where *extroverted* is). Likewise, *trusting* can be viewed as a blend of high *nurturance* (high *X* axis) and low *dominance* (low *Y* axis), and so on for the other traits. In addition, the circle is used to convey the *interrelationships* of the traits in the model. The closer the traits are to one another on the circle, the stronger their relationship and the higher their (positive) correlation. The circle provides a powerful tool for interpreting interpersonal traits and other traits that may have some interpersonal (person-to-person) content (Gurtman, 2020; Barford, Zhao, & Smillie, 2015; Wiggins & Broughton, 1991; Trapnell & Wiggins, 1990; Wiggins, Phillips, & Trapnell, 1989).

interpersonal circle a two-dimensional personality trait model based on blends of dominance and nurturance.

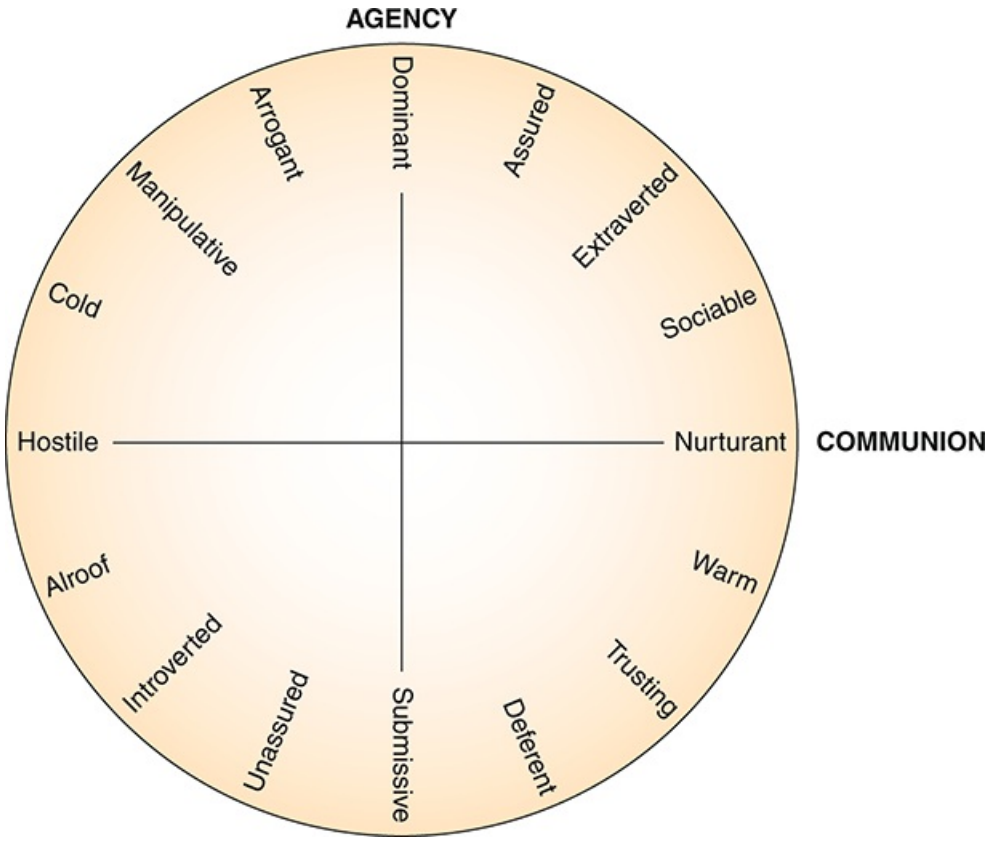


FIGURE 12.3 The Wiggins interpersonal circle of traits.

Another advantage of the interpersonal circle model is that it tracks the fact that how people present, or act, varies depending on who they are interacting with and the social contexts in which they are interacting. As originally suggested by Timothy Leary (1958) before he quit Harvard University and became a counter-culture guru advocating the use of LSD as a means of expanding one's conscious experience, the interpersonal circle model supports the idea that a healthy personality is not a fixed structure, but instead is a flexible one that shifts in ways that optimize the outcomes of social interactions. The model helps clinicians figure out how to get overly rigid clients, such as those who are dominant or domineering, get unstuck and become more flexible and responsive in their social interactions (Hopwood, 2018; Critchfield, Benjamin, & Levenick, 2015; Benjamin, 2002). As you will see, when we talk about personality disorders later in this chapter and in Chapter 15, rigidity or a lack of flexibility in personality areas can be quite problematic.

Evaluating Trait Theories

As we have noted, a number of questions have been addressed by research into trait theories. First, do traits apply to a variety of cultures? Eysenck found that his superfactors described basic types across a number of countries. In addition, there is growing evidence that people in many cultures display personality types that can be captured by at least three of the Big Five superfactors and sometimes by all five (McCrae, 2017; Bowden et al., 2016; Correa & Rogers, 2010).

A second question is whether traits, and the behaviours they produce, remain stable across

situations. The answer appears to be sometimes yes and sometimes no. In a classic investigation conducted in the early 1980s, investigators observed college students and rated their levels of *conscientiousness*, based on behaviours ranging from being punctual to completing assignments on time and tidying their rooms (Mischel & Shoda, 2010; Mischel & Peake, 1982; Mischel, Mendoza-Denton, & Shoda, 2002). The researchers found that levels of conscientiousness were relatively stable across *similar* situations, but not particularly consistent across very different situations. That is, persons who are punctual for class will likely be punctual for dates, because those situations and their demands are similar. However, individuals who are punctual may not necessarily keep their rooms clean. Although both of these situations require conscientiousness, the situations are quite different, leading to inconsistent displays of conscientiousness for some people.

A third question is whether traits, and the behaviours they dictate, are stable over time. Studies indicate that personality traits are more stable over a short period of time than over a span of years (Golsteyn & Schildberg-Hörisch, 2017; Donnellan, Hill, & Roberts, 2015). People who conscientiously show up on time for an appointment today are likely to be punctual for appointments next week and next month. But today's punctuality is not as likely to predict punctuality a year or two from now.

Similarly, traits often show inconsistency across a person's lifespan, especially as individuals grow from childhood to adulthood (Edmonds et al., 2013). For example, people who score high on the *openness* superfactor (adventurous, imaginative, and untraditional) during their teenage years may display less openness in their fifties. Researchers disagree on why such lifespan changes occur. Some believe that they reflect intrinsic, biologically based maturation while others hold that they have more to do with changes in an individual's social environment (Bleidorn & Hopwood, 2018; Specht, 2017). Either way, it is worth noting that once a person reaches adulthood, lifespan fluctuations seem to lessen, and traits become increasingly stable across the adult years (Harris, Humphrey, Migo, & Kopelman, 2016; Milojev & Sibley, 2014; Anusic & Schimmack, 2016).

Ableimages/Getty Images, Inc.

Another benefit of conscientiousness **An elderly teacher carefully demonstrates to a student how to operate woodwork equipment both safely and productively. Studies indicate that, on average, conscientious people live longer than less responsible individuals.**

Finally, the predictive value of a model is another issue of concern to researchers. Although trait theories do not necessarily claim to serve as a device for predicting what will happen in a person's life, it is tempting to apply them in this way. In fact, the idea that personality factors may be able to predict broad outcomes dates back many years. One longitudinal investigation found that the Big Five superfactor *conscientiousness* helps to predict the length of a person's life (Kern & Friedman, 2008; Friedman, Kern, Hampson, & Duckworth, 2014). (See photo.) In this study, a large number of children were followed for 70 years by several researchers. When the children were 11 years old, their parents and teachers rated them on various personality dimensions, and subsequent records were kept about these individuals and the causes of their eventual deaths. It turned out that, on average, those who had been rated as conscientious lived significantly longer than those who had not been rated as conscientious. To explain this finding, the researchers speculated that conscientiousness is related to a broad pattern of health-related behaviours, such as not smoking and not drinking—behaviours that add up over a lifetime. Similarly, research has suggested that certain personality attributes may be predictive of marital satisfaction. One study found, for example, that high agreeableness greatly increases the chances of having a happy and satisfying marriage (Abbasi, 2017; Donnellan, Conger, & Bryant, 2004), as do conscientiousness, emotional stability, and intellectual openness.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

8. Who are Gordon Allport and Hans Eysenck, and what were their contributions to the trait perspective?

9. What is factor analysis, and how is it tied to trait theories?

10. How is the interpersonal circle model of personality organized?

11. How stable are traits over time and across situations?

What Do You Think? • Think of three famous people and predict how they each might score on the major trait categories of the five-factor model.

Personality Assessment

LEARNING OBJECTIVE 4

Describe the two major types of personality tests, and give examples of each.

Go to almost any pop-culture Internet site (for example, www.queendom.com) or flip open any newspaper or popular magazine and you will likely find evidence of people's desire to understand, describe, and use personality traits. Astrology, personality quizzes, and even clairvoyants offer personality-based analyses and advice to thousands of people worldwide. The fact that devices such as horoscopes have been shown repeatedly to be unreliable has done little to diminish their popularity (Mazur & Watzlawik, 2016; Fichten & Sunerton, 1983). Of course, there are also more formal tools for assessing personality, and these tools are used in a variety of important contexts. Clinicians use personality assessment tools, including projective tests, which are discussed later in this chapter, to learn more about their clients' problems. Researchers may use them to conduct personality research or to help select participants for their studies. Employers, job counsellors, and industrial organizational psychologists often use such tools to maximize rates of retention of the most productive employees (Li, Barrick, Zimmerman, & Chiaburu, 2014) or to help their work teams function more effectively (Guchait, Hamilton, & Hua, 2014). For a look at the applications that industrial/organizational psychologists make of the trait approach to workplace settings, check out the Psychology@Work video on Individual Differences. Scores on traits such as conscientiousness have, for example, been used to predict absenteeism, misconduct, and termination (Wilmot & Ones, 2019). The personality tests used most frequently by these professionals are personality inventories, while some clinicians use projective tests, which will be discussed later in this chapter.

Video **PSYCHOLOGY@WORK**

Individual Differences This video looks at the ways in which

industrial/organizational research and practice applies the assessment of individual differences to workplace settings and touches on the ethical implications of diversity in relation to these activities.

Personality Inventories

You have very likely taken a personality inventory at some time in your life. **Personality inventories** are questionnaires that require individuals to respond to a series of true–false or agree–disagree statements designed to measure various aspects of personality. These types of assessments are called self-report inventories because they depend on information that respondents supply about themselves.

> **personality inventory** a questionnaire designed to assess various aspects of personality.

For the general public, today's most widely used scientific personality inventories, used by researchers and practitioners alike, are based on a personality theory and model called the **five-factor model** (FFM) (Widiger, 2017; Wiggins, 1996). The five traits of the FFM (see figure 12.3) are: *openness to experience*, *conscientiousness*, *extroversion*, *agreeableness*, and *neuroticism* (see **Figure 12.4**). The FFM is sometimes referred to as the OCEAN of personality, to signify its wide coverage and application. (Tip: OCEAN is also a useful acronym to help remember the five traits.) The most popular FFM inventory is the *Revised NEO Personality Inventory* (NEO PI-R) (Costa Jr. & McCrae, 2008). Another widely popular personality inventory for the general public is the Myers-Briggs Type Indicator (MBTI) (Myers, 1962), which is based on Jung's writings about personality and is typically used by businesses to understand personality dynamics in workplace settings. The MBTI is used as a catalyst to get people within organizational teams and groups talking about their social interactions, but it lacks the validity required of inventories used to make hiring and promotion decisions (Moyle & Hackston, 2018; Emre, 2018). Interestingly, the most widely used personality test by all kinds of psychologists is one developed not for the general public but for abnormal populations, called the Minnesota Multiphasic Personality Inventory 2 (MMPI-2) (Butcher et al., 2015; Butcher, 2001). A person's responses on this test are used primarily to assess psychological disorders (discussed in Chapter 15). The items on this test were selected much differently than the other tests we mentioned. They were not selected according to any theory or model. MMPI items were *empirically* derived (Williams, Butcher, & Paulsen, 2019). This means that many possible test items were administered to groups of people with various personality styles and psychological disorders, and their responses were analyzed to determine which items had predictive value and which patterns of responses corresponded to particular personality styles and diagnostic groups. It is important to note that the test questions do not necessarily have to make intuitive sense but are instead kept on the test if they have predictive value. For example, if most people who score high on extroversion choose green or depressed people choose black as their favourite colour, then the question, "What is your favourite colour?" has predictive validity and would remain on the test, even though it is not clear at this time, *on the face of it*, what "green" has to do with personality, though black does seem to make some sense in relation to depression. It is in this sense that empirically derived test items

may lack face validity even though they may possess predictive validity. Interestingly, tests having both face *and* predictive validity tend to be more accurate overall (Kreis et al., 2012; Broughton, 1984).

five-factor model an empirically derived trait model that proposes five major trait categories: agreeableness/disagreeableness, extroversion/introversion, neuroticism/stability, conscientiousness/irresponsibility, and openness to experience/unimaginativeness.

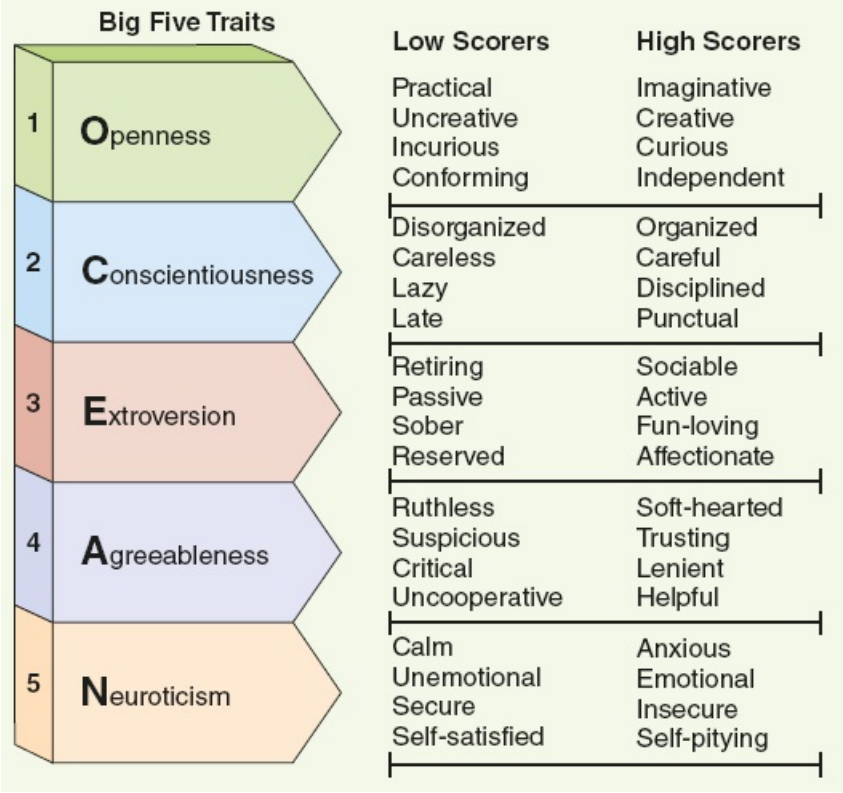


FIGURE 12.4 The five-factor model of personality Studies using factor analysis have identified five broad categories of traits, known as the Big Five. Many researchers believe that individual differences in personality can be captured by these five categories.

Source: Adapted from Cattell, R. B. Personality pinned down. *Psychology Today*, July 1973, pp. 40–46.

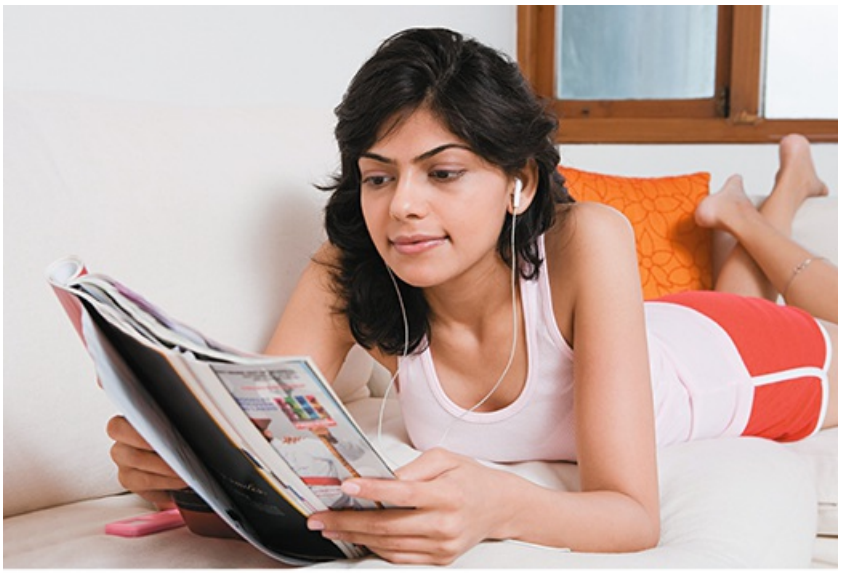


Image Source/Corbis Images

Personality quizzes **Personality inventories are more carefully put together in terms of reliability and validity than the personality quizzes in magazines.**

Despite the popularity of personality inventories, concerns have been raised about their use as accurate indicators of personality. Some researchers say the tests, which rely on self-reports, may not always be accurate (e.g., Spaans et al., 2017). Also, if we are not fully aware of our own behaviour patterns, preferences, or interests, our self-reports may not reflect our actual personality. Most researchers in the personality area say you can avoid these criticisms by properly validating self-report tests with behavioural measures. For example, Costa and McRae (2010) have found that those scoring high on the NEO PI-r conscientiousness scale receive higher supervisor ratings at work, are generally more punctual for class and appointments, and are more likely to complete their university degree, among other findings.

Another concern is that personality tests may not always be used and applied properly. Some employers, for example, use measures of conscientiousness to predict an applicant's potential job performance because, as mentioned, they are quite effective predictors of that type of performance. But some jobs are not well suited for conscientious people, at least not overly conscientious people (Sulea, Fischmann, & Filipescu, 2012; Hogan & Ones, 1997). As well, openness to experience (finding new ways to do things), in addition to conscientiousness, adds to performance when the job is complex (Blickle et al., 2013; Wiersma & Kappe, 2016).

Still another concern is that test-takers may tailor their answers on personality inventories to try to create a good impression—a phenomenon known as **socially desirable responding** (Viswesvaran & Ones, 1999). For example, the adjective "unintelligent" is a very undesirable trait term. It is so undesirable that on one popular personality test, this item, for over 40 years, was never endorsed by anyone! On the other hand, "intelligent" is almost always highly endorsed (Gough & Heilbrun, 1983). So on the basis of their extreme social desirability standing (never endorsed versus always endorsed), these two items, and items like them, are not good test items because they have no predictive validity—they are

virtually the same for everyone. Delroy Paulhus (Bensch, Paulhus, Stankov, & Ziegler, 2019; Paulhus, 2017, 2012), at the University of British Columbia, has studied this topic extensively and has shown that the way to control for social desirability on personality tests is to use items that are relatively equal in their social desirability standing. The problem of socially desirable responding was also anticipated by the creators of the MMPI. They included certain questions, called *validity items*, in the questionnaire to assess the likelihood that a respondent would purposely give an answer that was socially desirable rather than accurate. Suppose, for example, that an individual keeps answering "true" to such items as "I smile at everyone I meet" and "false" to "I get angry sometimes." It is assumed that these responses, and perhaps many others as well, are instances of socially desirable responding because it is highly unlikely that such a respondent is in fact a perfect saint (unless you are another Mother Teresa). In such cases, test scorers may disregard or adjust the respondents' personality scores.

socially desirable responding tailoring answers on personality inventories to try to create a good impression.

The use of personality tests as part of organizational hiring processes has a long history. However, early personality tests were not demonstrated to be particularly good (reliable or valid) at predicting who the best candidate for a job would be. As a consequence, in the United States there were a number of successful lawsuits claiming that hiring decisions based on older personality tests were unfair (Youngman, 2017; Rothstein & Goffin, 2006). In Canada, there was much less litigation. Currently, there are a number of better-designed personality tests that do, in fact, meet legally defensible criteria for use as pre-employment selection tools (Youngman, 2017; Rothstein & Goffin, 2006). The use of such tests in Canada is regulated by bodies such as human rights commissions, which limit the types of personal information employers can ask prospective employees to questions (including personality test questions) that are directly relevant to the job for which they are applying. Tests must be carefully constructed to ensure they meet these criteria and also show appropriate levels of reliability and validity (Kline, 2015).

Projective Tests

Projective tests are quite different from personality inventories (see **Figure 12.5**). These tests are commonly used by psychoanalytic clinicians and researchers and are intended to tap into a person's unconscious mind to detect personality styles and conflicts hidden beneath the surface. The most widely used and famous projective test is the *Rorschach Inkblot Test*. During the test, participants are presented with a set of 10 inkblots and asked to explain what they see. The ambiguous shapes of the inkblots are intended to force participants to *project* structure and meaning onto the images, and the participants' responses are thought to reveal underlying psychological themes and personality issues. For example, a person who sees images of animals or weapons in the inkblots is often thought to be grappling with underlying aggressive urges.

projective test a personality assessment device intended to tap a person's unconscious by presenting the person with an ambiguous stimulus and asking the

person to interpret what the stimulus means.

Some clinicians believe that the Rorschach test provides useful suggestions that can enhance the effectiveness of assessment and therapy or guide forensic assessments (Di Nuovo & Castellano, 2016; Tibon-Czopp & Weiner, 2016). It is widely agreed in the scientific community, however, that projective tests, such as the Rorschach, display low validity, or accuracy (Smith et al., 2018; Riley, Combs, Davis, & Smith, 2017; Kleiger, 2016). Scoring of the tests depends heavily on interpretations by the test administrators—interpretations that may be affected by the assessor's professional biases or level of expertise. In addition to problems with validity, many have concerns about the reliability, or consistency, of projective tests. Studies have shown that individuals who take a Rorschach test today may offer responses that are very different from those they offered when they took the test last week, leading to different personality assessments. Look again at the sample in **Figure 12.5**. You can probably see why the Rorschach test might present difficulties.

An alternative and commonly used type of projective test is the *Thematic Apperception Test (TAT)*. This tool, created in the 1930s by psychologist Henry Murray (1943), is made up of ambiguous black-and-white drawings of people in various situations. Test-takers are asked to describe and make up a story about each drawing. The uses and criticisms of the TAT are similar to those of the Rorschach. Although some systematic scoring procedures exist, most clinicians rely on their own judgments when analyzing an individual's TAT responses (Piotrowski, 2017; Jenkins, Dobbs, & Leeper, 2016). Additionally, it is difficult to know for certain that the stories created by individuals reflect how they are actually feeling; they may instead represent the individuals' projections of how they believe they should be feeling (McCredie & Morey, 2019).

Zmeel Photography/iStockphoto

Vincent McIndoe/Illustration Source

FIGURE 12.5 Projective tests Clinicians often use tests that consist of vague shapes or situations to help assess personality. Shown here is an inkblot similar to those used in the Rorschach Inkblot Test and a picture similar to the ones used in the Thematic Apperception Test.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

12. How do personality inventories differ from projective assessment techniques?

13. What factors make up the Big Five model?

14. What is socially desirable responding and how is it addressed in the MMPI-2?

15. What are some problems with projective assessment techniques?

What Do You Think? • There are so-called personality tests all over the Internet. Which ones have you come across? Why are most such tests uninformative and often misleading?

The Situationist and Interactionist Perspectives

LEARNING OBJECTIVE 5

Describe and differentiate the situationist and interactionist views of personality.

In terms of the big picture question of where personality comes from, we have looked at theories like Freud's that put a lot of weight on inherited instincts, with some parent–child interaction to trait approaches that also lean toward factors such as temperament that influence how we come to present ourselves socially through or personality profiles. However, an obvious question concerns the extent to which our personalities are formed by the situations or circumstances in which we find ourselves. Walter Mischel (2004) took a strong stance against the general idea that personality is largely made up of internal traits and instinctual factors and, instead, argued for the importance of situational factors in shaping and directing human behaviour. If you think back to the theories we covered in Chapter 7, you will have guessed some of the other psychologists who have looked closely at the role of situational influences on personality.

The Situationist Perspective

Situationist theorists acknowledged that personality factors come into play when people are making choices, reacting to events, or displaying other behaviours. Nevertheless, the theorists argued, situational "pushes" and "pulls" rule in most instances.

The behaviourist B. F. Skinner, discussed in Chapter 7, could be said to have viewed personality from a situationist perspective. Indeed, Skinner believed that human behaviour was completely shaped by environmental factors. What we call *personality*, Skinner saw as simply a certain consistency in what he called *response tendencies*. By that, Skinner meant that we approach life in a certain way because some of our behaviours have been rewarding to us in the past while other behaviours have not. That is, we tend to favour, or

repeat, responses that have previously helped us gain a desired outcome or avoid an undesired one. Whereas a trait theorist might look at your presence in college or university as some combination of intelligence, conscientiousness, and perhaps a little neuroticism, Skinner would have said that you studied because you found academic achievement to be rewarding or because studying served to keep your parents happy. Because these outcomes were sufficiently motivating, you developed a general response tendency to persist at studying, which led you to respond consistently and successfully in academic situations (Evans, 1968).

Caiaimage/Robert Daly/Getty Images

Situationism **Situationism is a view of personality that notes that in many social situations, such as a surprising scene in a play, people respond in fairly similar ways, meaning that the situation drives their response rather than their personality.**

Situationism has a strong appeal. As we already mentioned, human beings appear predisposed to explain their own behaviour in situational terms, although they tend to explain others' behaviour in terms of traits. How often have you responded "it depends" when somebody has asked how you would handle a situation? (see photo). Certainly, we do not like to think of ourselves as "trait machines"—robots who behave as if we were preprogrammed.

situationism a view of personality, which notes that in many social situations people respond is similar ways, meaning that the situation drives their response rather than their personality.

At the same time, however, we must note that there really can be no such thing as *pure* situational factors in human behaviour (Ewen, 2014). Consider, for instance, Skinner's

perspective on reward. As you saw in Chapter 7, Skinner defined a *reinforcer* as something that leads you to engage more often in a particular behaviour. In other words, what is a reinforcer to you may not be a reinforcer to someone else. Ultimately, even as we acknowledge the power and influence of situations, we must acknowledge the power and influence of people and their personalities; if not, we have trouble arguing about the importance or even the possibility of ethics or the personal management of our social behaviour (Bates & Kleingeld, 2018; Miller, 2017). Thus, it is not surprising that many situationist theorists, including Walter Mischel, the perspective's early leader, came to believe that the most appropriate models are those that try to integrate both personality variables and situational factors to explain behaviour, eventually moving to an interactionist perspective of personality.

The Interactionist Perspective

Interactionism focuses on interactions between people and situations. At the centre of the interactionist model is the idea that people influence the situations they encounter. According to this model, the choices you make, such as attending your present college or university or being enrolled in your present classes, are functions of underlying personality traits. Let's say, for example, introversion leads you to choose a school with really small classes—a choice that you suspect would make it more comfortable for you to participate in class—or a school with really large classes—a choice that you believe would make it easier for you to go unnoticed in class. Such choices are likely to result in self-fulfilling prophecies. If you choose the school with big classes, for example, the large class sizes will indeed help ensure that you can remain quiet in class and continue your introverted style. This idea that individual and situational variables interact suggests a way of moving beyond the trait-versus-situation controversy.

> **interactionism** a view emphasizing the relationship between a person's underlying personality traits and the reinforcing aspects of the situations in which they choose to put themselves.

One of the leading interactionist theories is cognitive psychologist (and Mundare, Alberta-born) Albert Bandura's *social-cognitive theory* (Bandura, 2016, 2008, 2006, 1986). Bandura is famous for introducing the concepts of modelling and self-efficacy to the study of human behaviour and personality. As you will recall, *modelling*, also known as *observational learning*, is a process by which people, especially as young children, learn to respond to particular situations by observing and imitating the behaviour of others. *Self-efficacy* refers to people's personal beliefs about their ability to achieve the goals they pursue. The higher your self-efficacy, the more likely you are to pursue a goal and, ultimately, to be reinforced by the outcome of your efforts (Locke & Latham, 2019; Levack et al., 2016).

How do these concepts influence personality? Through a process Bandura called *reciprocal determinism*. In Bandura's way of thinking, the external environment, internal mental events (such as one's beliefs and expectations), and behaviour all interact with one another. How, for example, might your current presence in college or university be explained? Bandura might note that as a child you observed your parents or friends studying or working hard, and as a result you engaged in similar behaviour when you entered the

school environment. Perhaps you were praised by teachers or your parents for good grades, which reinforced that behaviour (see photo). You may in turn have developed a confident belief that you were a good student and curious about and open to new experiences, and your high level of self-efficacy may have led you to persist in behaviours (listening, completing your homework, studying) that further led to desired reinforcements (praise, good grades, positive self-image).

Stefan Dahl Langstrup/Alamy Stock Photo

Bandura's theory of reciprocal determinism **In Bandura's view, personality is determined by the interaction of the external environment, internal mental events, and behaviour. For example, receiving good grades and praise for schoolwork as a child may help you believe that you are a good student and this high level of self-efficacy may further lead to behaviours (studying and doing homework) that produce further desired reinforcement—more good grades and praise.**

The major advantage of this perspective over other theories of personality is that Bandura's theory, with its special emphasis on observable variables, such as models, behaviours, goals, and outcomes, is readily testable. There is a vast amount of data linking both modelling and self-efficacy to personality development and change across the lifespan (Adams et al., 2020; Huang, 2016; Alessandri et al., 2016; Mroczek & Little, 2014).

With an interactionist perspective in mind, some personality researchers uncovered a different kind of consistency in human affairs: not trait consistency, not situation consistency, but *disposition-situation* consistency, which seems to have useful implications for organizational (persons in organizations) psychology. They have discovered that interactive effects between dispositions (traits) and situations are common, and that disposition-situation relationships often show stability (Fajkowska, 2018; Furr & Funder, 2018; Lamiell, 2018; Tasselli, Kilduff, & Landis, 2018). Such stability would be reflected by the statement, "We can change our organizational culture in ways that will lead to positive changes in the levels of consciousness and competitiveness among our employees."

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

16. What is the situationist view of personality, and what theorists played key roles in promoting it?

17. What is the interactionist view of personality, and how does Bandura's social-cognitive theory fit into this perspective?

What Do You Think? • How might Skinner and Bandura each view someone's failure to quit smoking?

Biological Foundations of Personality

LEARNING OBJECTIVE 6

Discuss the heritability of personality traits and some of the neural systems that may be involved in the expression of personality.

You saw earlier that the trait-versus-situation debate has moved toward an interactionist view. As we mentioned, the traditional nature–nurture debate has changed in much the same way. In recent years, many researchers have been trying to understand the *relative* contributions of genetic and environmental factors to the development of personality. Other researchers have been investigating what brain structures and other neurological factors affect personality patterns. Let's see what they have found.

T.K. Wanstal/The Image Works

Separated at birth **Identical twins Gerald Levy and Mark Newman were separated at birth and did not meet or know of each other's existence until adulthood. In the**

interim, they had both become firemen and developed a range of very similar personality characteristics, mannerisms, interests, and hobbies.

How Much Do Genetic Factors Contribute to Personality?

As we have seen throughout this book, situations in which twins are separated very early in life and raised in different families afford researchers a unique opportunity to study the separate effects of genetics, shared family and social environments, and non-shared environments. Perhaps the most famous of these twin adoption studies is the *Minnesota Study of Twins Reared Apart* (MISTRA) (Wilson et al., 2019; Segal, Montoya, & Becker, 2018; Joseph, 2014). This investigation focused on 59 pairs of identical twins who had been raised in different families and 47 pairs of fraternal twins raised in the same household. Recall that identical twins have exactly the same genetic structure, while fraternal twins are no more genetically similar than non-twin siblings.

The twins who participated in the study spent six days taking personality and intelligence tests. The identical twins proved to be substantially more similar on every psychological dimension than the fraternal twins, even though the identical twins had been raised in separate homes and families. These results suggest that shared environments are less important than genetic factors to the development of temperament and many personality traits, although shared environments certainly do contribute (Bouchard Jr., 2016; Segal, 2012). (See photo.)

Some broad traits appeared to have particularly strong genetic links (see **Figure 12.6**). For example, in twin studies of personality, the superfactor *agreeableness* from the Big Five scale had an estimated heritability coefficient of .40, and the heritability coefficient (which ranges from 0 to 1.0) of the superfactor *openness* was estimated to be .55 (Young et al., 2019; Bouchard, 2004). Among more specific traits, the heritability coefficient for *warmth* was estimated to be .23, while that for *excitement* was estimated to be .36 (Feist, 2019; Jang et al., 1998).

Some researchers have suggested that certain behavioural tendencies, which are expressions of personality, may also have an inherited component. For instance, genetic factors may contribute to an individual's tendency to watch television (Huppertz, de Geus, & van der Ploeg, 2018; Prescott, Johnson, & McArdle, 1991). Even more complex behaviours, such as the tendency to get a divorce (Salvatore et al., 2017) and to develop alcoholism (Chassin, Colder, Hussong, & Sher, 2016; Froehlich, Zink, Li, & Christian, 2000), have been found to be partially heritable. Of course, no single gene is at work in traits or in behaviours such as these. More likely, multiple genes interact and affect an individual's broad biological systems, and these systems contribute to the traits or behaviours in question.

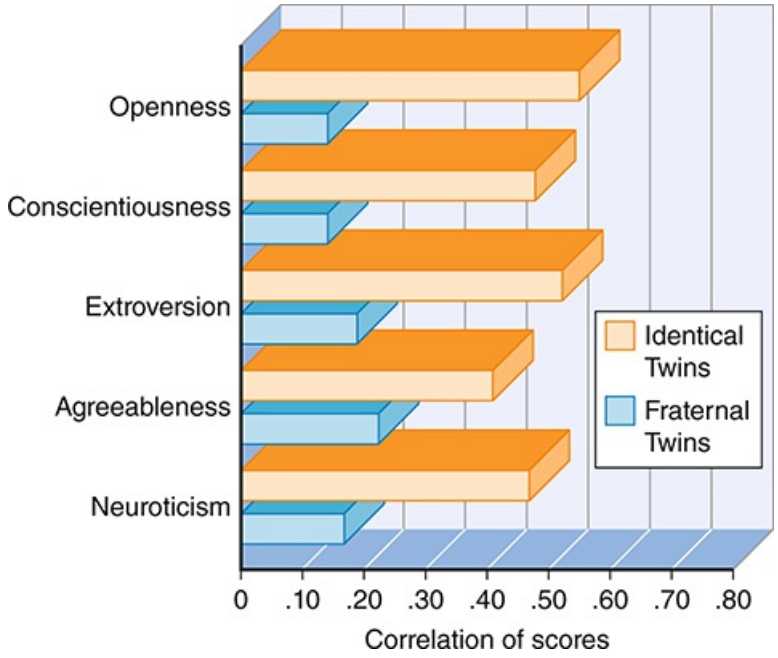


FIGURE 12.6 Heritability of the Big Five traits among twins Studies comparing identical twins (who share 100 percent of their genes) and fraternal twins reveal that the Big Five personality traits have a strong genetic component (Loehlin, 1992).

Source: Adapted with permission From Weiten. *ACP Psychology: Themes and Variations, FIU EDITION, 6E. © 2004 Wadsworth, a part of Cengage Learning, Inc. Reproduced by permission. www.cengage.com/permissions

The media has embraced the Minnesota Twin Study for its straightforward findings. It is easy, though, to misinterpret the meaning of heritability statistics. Based on their findings, for example, the study's authors estimated that the *heritability coefficient* of IQ is close to .70 (other studies suggest that it is closer to .50). Does this mean that IQ is 70 percent genetic and 30 percent environmental? No. As noted in Chapter 10, the heritability coefficient is related to the total variance in a population, not to the variance within a given individual. That is, a heritability coefficient of .70 means that 70 percent of all differences observed in the tested *population* are due to genetic factors rather than to environmental differences.

Whatever the genetic pathway, even strong proponents of a genetic model recognize that environmental experiences also play a critical role (Zuckerman, 2012, 2011; Wahlsten, 2016). Recall that Eysenck considered personality traits to be biologically based and proposed that the superfactor *psychoticism* served as a marker of psychotic tendencies, such as schizophrenia. Even Eysenck, however, discovered that persons who are predisposed to high levels of psychoticism will not necessarily develop schizophrenia. Their environmental experiences help determine whether they will become disabled by their genetic disposition or channel that disposition into more productive behaviours.

Personality and the Brain

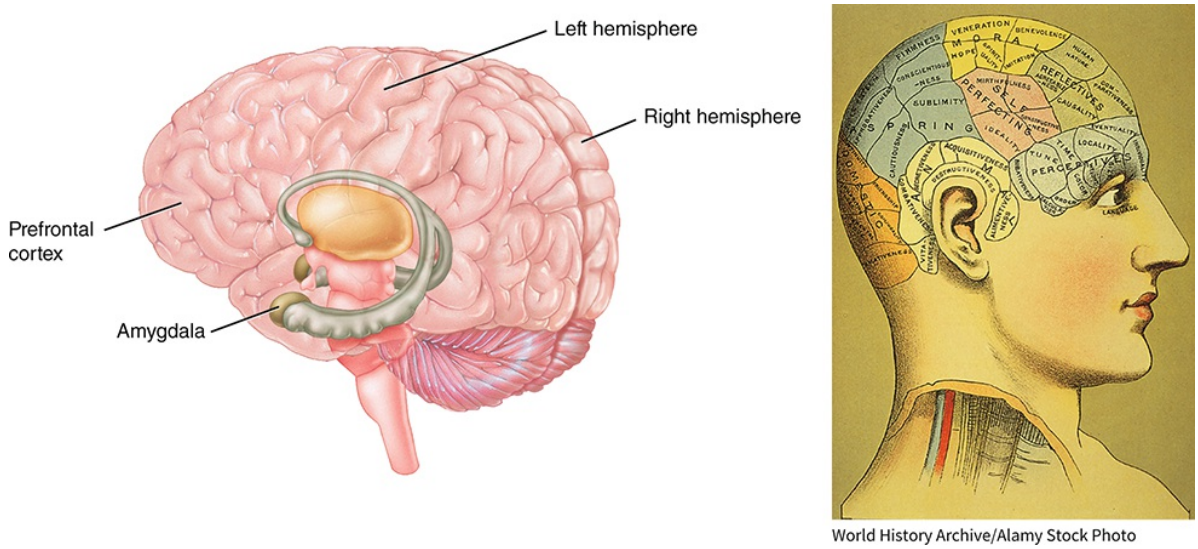
Twin studies, as we have seen, suggest links between genes and personality. But these studies do not provide precise information about what biological systems affect personality patterns. The search for such systems dates back to Franz Joseph Gall (1758–1828). Gall developed the theory of **phrenology**, a method of assessing a person's mental and moral qualities by studying the shape of the skull. He believed he could pinpoint specific parts of the brain that were responsible for distinct personality qualities by feeling the bumps they raised on the skull (see **Figure 12.7**). The practice became quite widespread between 1820 and 1850 (Gall, 1833).

> **phrenology** a method of assessing a person's mental and moral qualities by studying the shape of the person's skull.

While Gall's techniques were later shown to be inaccurate, his ideas about the localization of brain functions and the role of the brain in personality continue to influence neurological science (Rooney, 2017). Many researchers are currently attempting to uncover how brain structures, neurotransmitters, and other factors influence personality (Montag & Davis, 2018; Dubois et al., 2017; Deris et al., 2017; Kernberg, 2016). Much of this research focuses on specific personality traits, but a new line of study is also examining higher-order personality variables, such as moral inclinations and self-concept (Farb, Desormeau, & Dinh-Williams, 2016).

Research on Neural Systems and Personality

Many studies suggest that certain *brain structures* help to regulate personality. As we have observed in previous chapters, the amygdala, a structure in the limbic system, plays a key role in emotionality, motivation, and the processing of negative stimuli, especially stimuli that activate fear and avoidance responses (Bigot et al., 2020; Gothard, 2020). Brain imaging studies have shown that people with damage to the amygdala have difficulty becoming conditioned to fear stimuli (Feinstein et al., 2013; LeDoux, 1999, 2017). The damage may prevent the amygdala from responding to stimuli that normally excite fearful responses in people without amygdala damage. Such studies have spurred a number of psychologists to theorize that children who display an inhibited personality—characterized by shyness and fear of the unfamiliar—may have amygdalas that are *too easily* activated, causing the children to be aroused too readily by unfamiliar or stressful situations (Kujawa et al., 2016; Lahat et al., 2014).



World History Archive/Alamy Stock Photo

FIGURE 12.7 Bumps, lumps, and personality Franz Gall proposed that personality could be determined by measuring the bumps on a person's skull, and he diagrammed the areas associated with particular personality traits. While his assumptions were wrong, his idea that some brain functions are localized is true.

Cerebral hemisphere dominance may also contribute in subtle ways to personality. Some studies have hinted that people whose right hemisphere is dominant experience more negative emotions and traits while those whose left hemisphere is dominant display more positive emotions and traits (Reznik & Allen, 2018; Davidson, 1998). One study found, for example, that participants who were generally sad and withdrawn displayed less activity in the left side of their prefrontal cortex—the part of the brain responsible for planned actions and thought and, in part, for emotional reactions to stress (Pliszka, 2016; Davidson & Fox, 1989). Moreover, the link between hemisphere dominance and personality may appear at a very early age. Psychologists have studied the brains of infants who show high levels of distress when separated from their mothers. Results indicate that such infants and infants living is stressful, impoverished environments tend to display heightened activity in the right-side prefrontal cortex (DeSocio, 2018; Blair & Raver, 2016; Galea & Lindell, 2016).

Neurotransmitter activity has also been linked to some personality variables. As mentioned earlier in this book, the neurotransmitter dopamine helps regulate the "pleasure pathway" (Sayin, 2019; Ayano, 2016). It is central to the brain's reward systems. High dopamine activity in the reward centres, for example, has been associated with positive emotions, high energy, and lack of inhibition, while low activity of this neurotransmitter has been linked to anxiety, inhibition, and low energy levels (Cools, 2019; Zuckerman & Donohew, 2015). Similarly, low serotonin activity has been associated with depression, violent behaviour, and impulsivity (Coccaro et al., 2016; Manchia et al., 2017; Nautiyal & Hen, 2017; Knutson et al., 1998).

Hormonal activity, too, has been tied to personality. The important hormone cortisol, secreted by the adrenal cortex to help regulate reactions to threatening experiences, has been tied to personality. As you read in Chapter 4, for example, Jerome Kagan (2010) conducted a famous study of inhibited children in 1994. He measured the blood cortisol levels of children as they were reacting to stressful situations. Recall that cortisol helps

regulate reactions to threatening experiences. Kagan found that the children with inhibited temperaments tended to have higher cortisol stress reactions to unfamiliar situations. Recall that temperament (as discussed in Chapter 4) is a way to describe early-appearing stable tendencies toward particular emotional states (called reactivity) and the ability to manage these states.

Organizing Research Findings

Numerous studies have looked at the link between biological processes and personality, yielding findings that are complex and often confusing. One of the most compelling methods for organizing these findings has been suggested by the researchers Lee Anna Clark and David Watson, who grouped personality types into three broad categories of temperament, similar to the superfactors proposed by Eysenck and the Big Five theorists (Kotelnikova, Weaver, & Clark, 2019; Clark et al., 2017; Watson & Naragon-Gainey, 2014; Watson et al., 2015).

Negative emotionality Individuals who have high levels of negative emotionality are thought to experience more negative emotions and see the world as distressing, whereas those low on this dimension are relatively peaceful and have higher levels of satisfaction.

Positive emotionality Measures of positive emotionality are thought to represent a person's engagement with their environment. High scorers are social individuals who lead active lives and exhibit enthusiasm, while low scorers are shyer and have less energy and self-confidence.

Disinhibition versus constraint The disinhibition/constraint dimension reflects how we regulate our various emotions. People high in disinhibition have difficulty controlling their emotional responses and tend to be impulsive, living for the moment. People high in constraint live more careful and controlled lives.

Note that negative emotionality and positive emotionality are two separate dimensions. These two types of emotionality are not necessarily at opposite ends of a spectrum. A person may score high on both, low on both, or high on one and low on the other.

Scores on the three dimensions are broadly related to particular lifestyle patterns (see **Figure 12.8**). Individuals high in negative emotionality are more likely to experience feelings such as anger, contempt, and guilt, while those high in positive emotionality tend to experience positive emotions such as joy, excitement, and pride. Some problematic lifestyle patterns may be found among individuals who score high on the disinhibition dimension. These individuals, who are high in impulsivity and do not act with long-term consequences in mind, tend to get poorer grades in school, perform more poorly in their jobs, and engage in riskier activities, such as drinking and using illegal drugs (Lozano, Gordillo, & Pérez, 2014; Mullins-Sweatt et al., 2019). Interestingly, "morning people" are more likely to be high in positive emotionality, while many "night owls" are high on the disinhibition dimension (Kivelä, Papadopoulos, & Antypa, 2018; Clark & Watson, 1999).

Interpreting Research Findings

Although research findings suggest links between brain functioning and personality, we must, as always, take care in interpreting these findings. The links just discussed are not

usually straightforward, and personality traits are never the result of a single biological process. The activity of one neurotransmitter—say, serotonin—is, at most, *partially* responsible for the regulation of a trait or emotion. Clearly, the relationships between biology and personality that have been discovered represent only a small portion of the complex neurological system.

In addition, it is important to remember that the patterns of brain activity that we have observed have not been shown to provide a causal explanation of traits. Particular biological processes associated with personality may themselves be the results of environment and experience. As you have seen, for example, studies indicate that life experiences, even very early ones, may affect both biological make-up and personality patterns, present and future. One study of rhesus monkeys found that baby monkeys who had endured high levels of abuse and rejection by their mothers displayed lower levels of serotonin activity in adulthood. Moreover, the lower their level of serotonin activity in adulthood, the more likely they were to abuse their own offspring (Shah et al., 2018; Coyne & Maestripieri, 2016). Clearly, environmental factors, even at an early age, greatly affect the neurobiological system, and that impact can be enduring.

In summary, we must be very careful about the conclusions we draw from genetic and neurological personality research. First, we must keep in mind that the brain operates as a system, and personality reflects activity in a number of regions, as well as the expression of multiple genes (Bulbena-Cabre, Nia, & Perez-Rodriguez, 2018; Bouchard, 2004). Second, we must recall that one gene may interact with other genes and affect a variety of personality dimensions (Sanchez-Roige et al., 2018). Third, we need to recognize that the environment affects the operation and impact of both genetic and biological processes. Those processes in turn affect how individuals interact with their environment. Given the complex, bidirectional relationships that occur between traits, biological factors, the environment, and behaviour, the only certain conclusion that can be drawn is that much more research is needed before we can truly understand the nature and causes of personality (Maruszewski, Fajkowska, & Eysenck, 2010). Check out Your Brain and Behaviour 12.1 to find out what areas of our brains are involved in altruism.

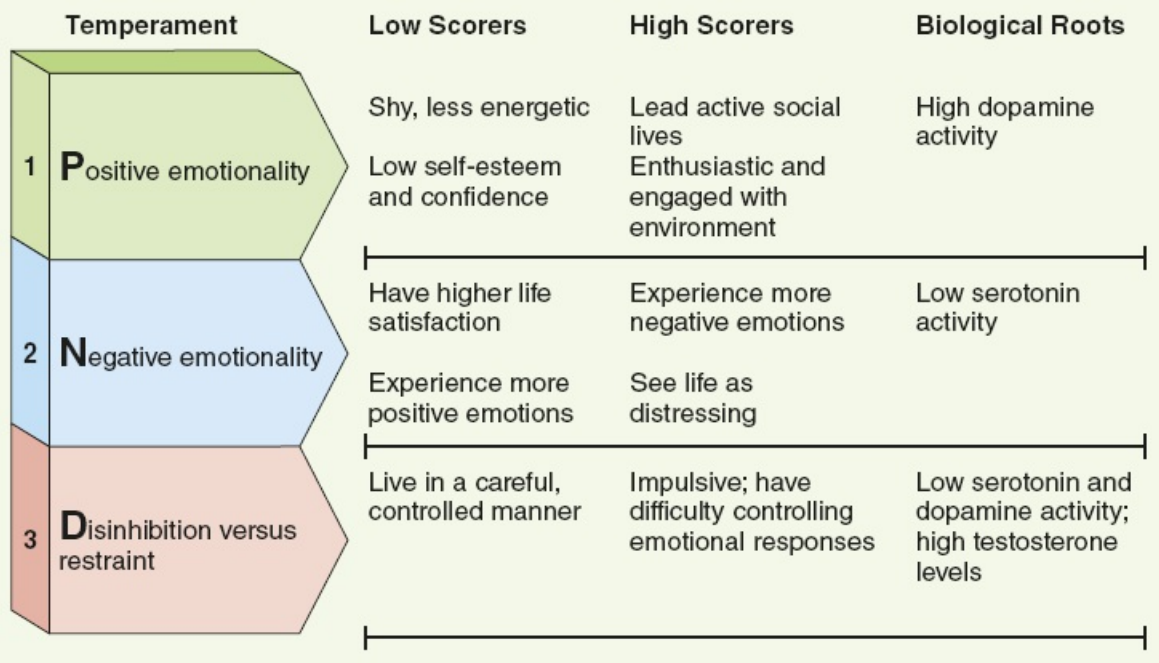


FIGURE 12.8 The biology of personality Clark and Watson grouped the findings from personality studies into three dimensions of temperament. Research evidence suggests that biological processes are at the root of these temperament dimensions.

12.1 Your Brain and Behaviour

Trait Theory, Altruism, and the Brain

Altruism is a core component of many cultures and acts of altruism are aimed at improving the welfare of another person; often it is defined selfless acts that help others with no expectation of reciprocity. Altruism is often thought of as specific to humans, however there are instances of altruism like behaviours in other species such as dolphins, primates, and elephants. In humans altruistic behaviours have been reported in young children and even infants (Filkowski, Cochran & Hass, 2016; Warneken & Tomasello, 2009).

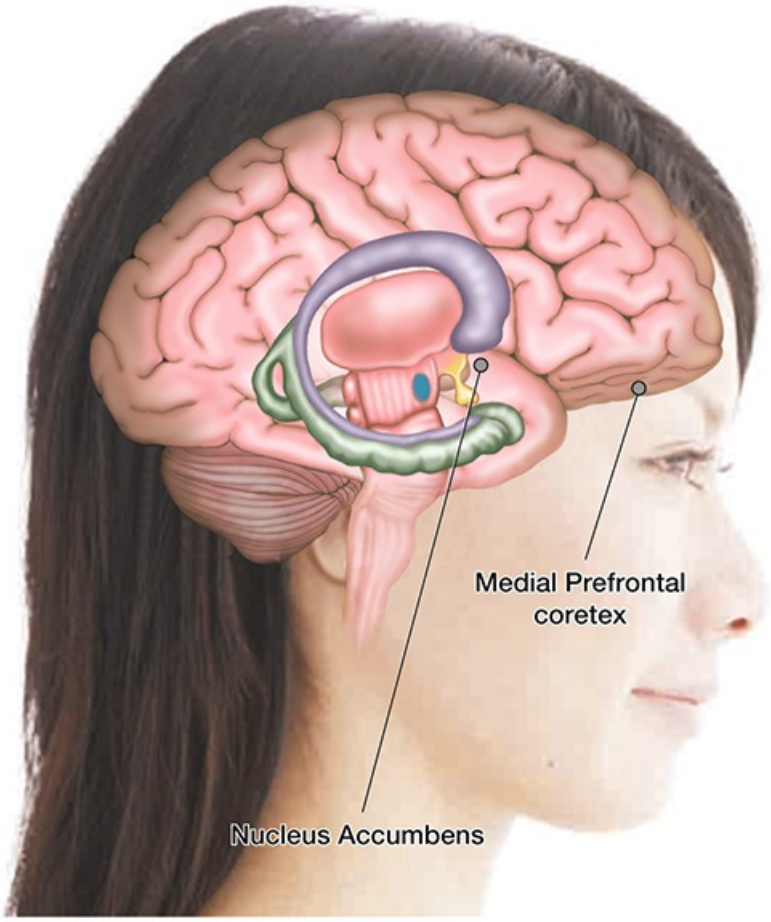
Specific personality traits (using the Big Five Personality Traits) may correlate to who we perform altruistic acts toward. A study from Britain also showed that people high on agreeableness, conscientiousness, and openness were more likely to value altruism and commit altruistic acts. (Furnham, Treglown, Hyde & Trickey, 2016). In work from Japan, researchers found that individuals high in conscientiousness were more likely to exhibit altruistic behaviour toward family members, those high in agreeableness were more likely to be altruistic with friends and acquaintances, and individuals higher in openness were more likely to help strangers (Oda et al., 2014). Whether this level of specificity between a personality trait of the giver, and the category of recipient receiving the assistance of the giver, stands the test of scientific scrutiny it does raise an interesting question - how is altruism activated in the brain?

Questions

What personality traits are more likely to exist in individuals who display altruism?

What areas of the brain are involved in altruism?

How does gratitude journaling affect the activation of the prefrontal cortex and nucleus accumbens during the imagination of an altruistic act?



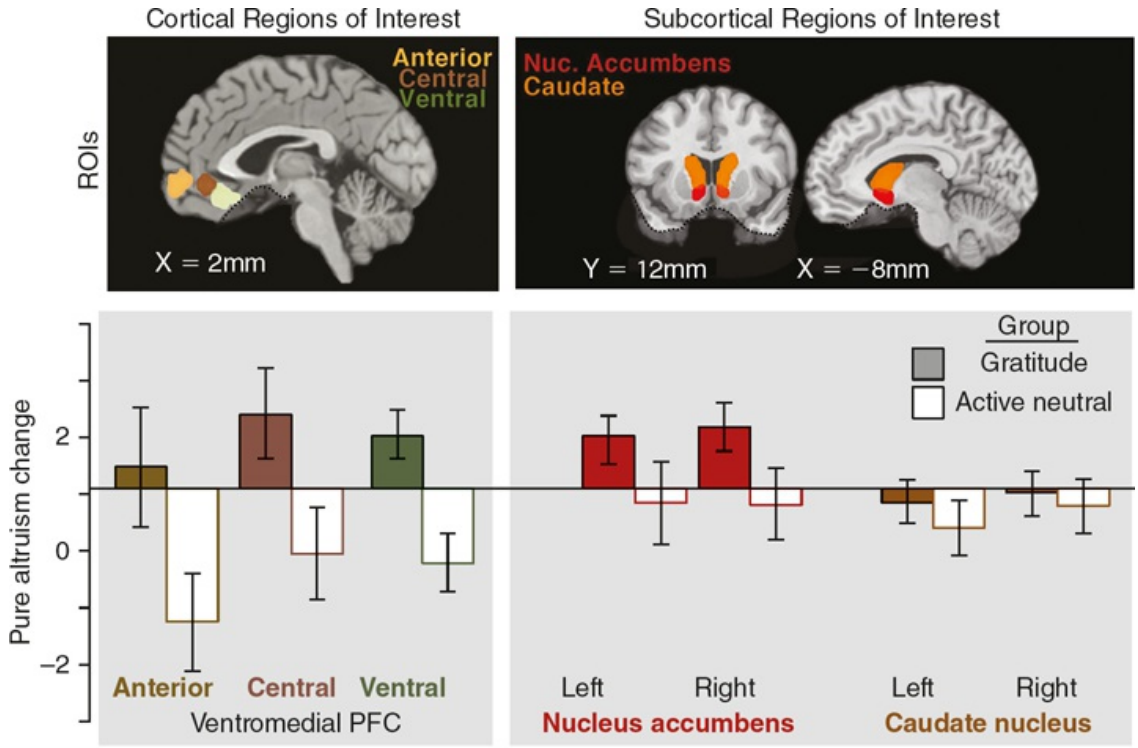
Source: Digital Vision/Getty Images

BananaStock/Getty Images

Selfless acts **Altruism can be as simple as bringing someone a warm cup of coffee or tea.**

Photo by Gabrielle Henderson on Unsplash

Altruism and the brain **Keeping a gratitude journal has been shown to increase activity in parts of the prefrontal cortex – specifically the ventromedial (in the middle and toward the bottom) portion of the PFC.**



Source: Filkowski, M. M., Cochran, R. N., & Haas, B. W. (2016). Altruistic behavior: Mapping responses in the brain. Neuroscience and Neuroeconomics, 5, 65.

Altruism and the prefrontal cortex **Recent neuroimaging work shows that there are several areas of the brain important for the expression of altruism including the prefrontal cortex and nucleus accumbens. How can you increase your likelihood of displaying altruism and changing your brain in that direction? In young women a double blind study was conducted where participants were assigned to either a gratitude journaling or control journaling condition for three weeks. During an altruism task the gratitude journaling group showed an increase in the neural activation of the prefrontal cortex and nucleus accumbens as compared to baseline. The caudate nucleus, an area involved in the control of movement, showed no change in activity levels (Karns, Moore III & Mayr, 2017).**

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

18. What do we mean when we say that the Big Five dimension of openness has a heritability coefficient of .55?

19. What is thought to be the role of the amygdala in the development of inhibited personalities?

20. What are the three categories of temperament proposed by Clark and Watson?

21. Why is it necessary to be careful in interpreting research findings associating particular personality traits with particular biological substances or structures?

What Do You Think? • Many of the same brain structures are involved in both emotion and personality. Discuss what you think this suggests about the relationship between emotion and personality.

Differences in Personality

LEARNING OBJECTIVE 7

Explain how gender and cultural differences can affect personality.

So far we have focused on ideas about how personality unfolds. Let's turn now to the question of group differences in personality. Are male and female personalities inherently different? Do personalities differ among different cultures and subcultures? We will examine these questions next.

Michaeljung/Dreamstime/GetStock

Personality and gender differences **While some people argue that there are personality features that are more typical for one gender than the other, it is actually the case that there are more differences across individuals within each gender than there are across the genders.**

Gender Differences

The 1992 book *Men Are from Mars, Women Are from Venus* (Gray, 1992) has sold more than six million copies in North America and been translated into 40 languages. The book's premise that men and women are entirely different clearly struck a responsive chord. But how accurate is this notion?

Research into Gender Differences

A number of studies suggest that the widespread belief in inherent personality differences between men and women may be no more than a myth. Recent broad reviews of studies on gender differences in personality, cognitive abilities, and leadership have found that the similarities between men and women far outnumber the differences (Abdallah & Jibai, 2020; Schmitt et al., 2017; Hyde, 2014, 2016). Differences among individuals of each gender are much larger than differences between males and females (McCrae & Terracciano, 2017). (See photo.)

Beyond all this, gender researchers have begun to note the importance of context in investigations of psychological gender differences. The situational and social context of a study—for instance, the male-to-female ratio in the experimental room—can greatly influence the nature and size of observed gender differences (Goodale et al., 2018; Bussey & Bandura, 1999; Eagly & Wood, 2016). Many psychologists rightly stress that incorrect conclusions about certain gender differences can perpetuate stereotypes and improperly affect men and women at work, at home, and in their professional lives (Brannon, 2016).

Roger Ressmeyer/Corbis/Getty

A caring life Operating against the stereotype that females are consistently more nurturing than males, animal shelter worker Sam Wheeler has devoted much of his life to loving and caring for unfortunate dogs and cats.

Nevertheless, we must be clear that some consistent sex differences have been documented. For example, women, on average, tend to be more accurate than men at assessing emotion in other people (Thompson & Voyer, 2014; Lambrecht, Kreifelts, & Wildgruber, 2014). The psychologist Carol Gilligan—who, along with Karen Horney, was one of the first theorists to focus on how women differ psychologically from men—argues that women and men, in fact, are most comfortable with different perspectives on the

world, although she also emphasizes that one perspective is not superior to the other, and both men and women are capable of adopting the other's perspective—think of them as masculine and feminine orientations (Gilligan, 2011; Gilligan & Snider, 2018; Larrabee, 2016). Gilligan, who was introduced in Chapter 4, believes that women are more attuned to interpersonal (relational) concerns when making moral decisions, while men are more likely to base such decisions on laws or abstract principles. Building on this idea, she has found that men, on average, score higher on traits that reflect individuality and autonomy, while women score higher on ones that emphasize social connectedness and empathy (Gilligan, 1982). Similarly, some investigations have indicated that women tend to display more nurturing behaviours (Eagly & Wood, 2016). (See photo.)

After statistically comparing the results of many studies relating to gender differences in personality, psychologist Janet Hyde (2018, 2014, 2008) found only a handful of variables on which females and males differed consistently. Those that she did find, however, seem to be important. Levels of aggression—particularly physical aggression—were somewhat higher among males. In addition, males were quite different from females on measures of motor performance and sexuality, and males and females had strikingly different attitudes about sex in casual, uncommitted relationships—men were more open to sex in such instances. As we noted in Chapter 11, the data on gender differences in sexual attitudes may be influenced by research participants' awareness that society expects men and women to behave in certain ways sexually. Still, it is clear that, overall, differences in aggression and attitudes may lead to significant differences in the expression of personality.

Why Do Gender Differences in Personality Exist?

Knowing about gender differences is similar to looking at the results of a personality assessment—both provide descriptions but do little to explain *why* certain patterns exist and what those patterns may say about future behaviour. A number of theories attempt to explain the personality differences observed in men and women.

One theory explains these differences in socio-cultural terms. After all, a person's self-concept, life goals, and values all develop in a social context. According to **social role theory**, girls and boys develop different personal styles, behaviours, and skills based largely on the division of labour between the sexes and the resulting differences in gender role expectation*s* (Koenig & Eagly, 2014; Eagly & Wood, 2016; Koenig et al., 2011). In other words, males and females develop the personality attributes that are best suited for the roles that they typically occupy. Some theorists believe that play behaviour in childhood helps teach gender roles and expectations. Young boys are expected to play competitive games, for example, and often are given aggressive-type action figures as toys. Girls, in contrast, are encouraged to play games that emphasize nurturing and interacting with peers.

> **social role theory** theory that gender differences occur because girls and boys develop different behaviours and skills based largely on differences in gender role expectations.

begalphoto/Shutterstock.com

Social roles **Social roles, such as learning how to box with an aggressive attitude, are learned socially but become powerful influences on behaviour.**

Family and social relationships may also contribute to the development of personality differences between boys and girls. As children interact with their families and peers, they form ideas about gender role expectations based on how those other individuals react to their behaviours (see photo). It is particularly important that the reactions of others teach children what behaviours and ideas are not appropriate to their gender role (Henley, 1977). A little boy may, for example, face disapproval if he plays with dolls rather than action figures (Mayeza, 2018). Similarly, girls' home social environments influence whether they will consider studying and working in a STEM (science, technology, engineering, and math) discipline (Eccles, 2015).

Broad cultural practices, often a reflection of religious and philosophical beliefs, are also significant in the development of male–female differences. Traditionally, men held a position of higher power than women in most societies, and this power structure had a "trickle-down" effect on smaller units of behaviour. Women, for example, often were limited to certain roles, such as child rearing, domestic work, and particular occupations (nurse, teacher, secretary). It may be that women were more likely to develop certain personality traits as a result of these constraints. Consider, for example, the superior abilities of women, on average, to read emotions and to perform in the social realm. Individuals who are in positions of less power or privilege may need to develop their skills at recognizing interpersonal cues and spotting the emotions of those in power to better address their own needs (Eagly & Wood, 2016; Eagly & Koenig, 2006; Koenig et al., 2011). They can use such skills as they try to make sure their own needs are met.

A number of theorists further propose that cultural norms influence how men and women form their self-schemas. As we discussed in Chapter 4, *schemas* are ways we organize knowledge. A *self-schema* is an individual's cognitive framework for the knowledge he has about himself. When we need to process new information about ourselves or our interactions, we refer to these schemas for guidance. A number of studies suggest that men

are more likely to have self-schemas that emphasize autonomy and independence, while women are more likely to have collectivist or relationship-based schemas (Starr & Zurbriggen, 2017; Yarnell et al., 2015). One team of researchers further hypothesized that an individual's self-esteem would be directly related to how well he lived up to gender-dependent schemas—a hypothesis supported by a study they conducted (Hoyle et al., 2019; Josephs, Markus, & Tarafodi, 1992). Research participants who were led to believe that they equalled or surpassed most of their peers in gender-specific skills and abilities had consistently higher levels of self-esteem.

Efforts to break free from social roles can take a toll on individuals. Thus, even the best-intended role breakers can only go so far. Perhaps you have noticed, for example, that some men are willing to support a female friend by going to a female-oriented movie or a flower show, but the same guys are much less likely to hold a friend's purse. And on those occasions when men do go that extra mile, they are often left in an uncomfortable emotional state. Researchers Jennifer K. Bosson and Joseph A. Vandello (2011; Bosson, Vandello, & Caswell, 2014) asked men to engage in a braiding task—half of them braided a length of rope, and half of them braided hair. Afterward, the men were given the choice of punching a bag or working a puzzle. The men who braided hair overwhelmingly opted to punch a bag. In another condition, men who were not allowed to punch a bag or engage in other aggressive behaviours reported high anxiety levels. In essence, according to Bosson and Vandello, if the men didn't get an opportunity to reassert some gender-stereotyped behaviour, their sense of manliness became threatened.

In addition to such socio-cultural factors, biological factors may play a role in gender differences in personality. In Chapter 3, for example, we discussed the nature and importance of *hemispheric lateralization* in the brain. It turns out that males and females may exhibit different degrees of hemispheric lateralization. Male brains tend to be more functionally lateralized than female brains: in male brains, one hemisphere is relatively dominant for various kinds of processing, while female brains appear to be more integrated (Zhang et al., 2020; Grabowska, 2017). Still other studies have found that the sex hormones, testosterone and estrogen, which are available in different amounts and often act differently in males and females, have major influences on behaviour and personal tendencies, leading many theorists to believe that they also contribute to gender differences in personality (Schmitt et al., 2017; Nostro et al., 2016).

In summary, it is true that, on the one hand, many of our society's beliefs about male–female personality differences are incorrect or overstated. A number of psychologists worry that the Mars–Venus myth of massive gender differences serves to perpetuate harmful misconceptions. Highlighting differences between men and women, for example, may support prejudicial beliefs and discriminatory practices against women (Coates, 2018; Zell et al., 2016). On the other hand, it is also true that that there is potential danger in not acknowledging the real differences that do exist between the genders. Such denial, argue a number of theorists, may serve to downplay the unique strengths and gifts of each gender. Perhaps the most appropriate response to this debate was offered by psychologist Diane Halpern, past-president of the American Psychological Association. There may be limited differences between males and females, Halpern stated, but "differences are not deficiencies" (Halpern, 2012).

Differences Among Cultural Groups

Around the world, each culture is characterized by its own values, beliefs, and to some degree, patterns of behaviour. These features help guide members of the cultural group, teaching them what they should value in life, how they should treat others in their group, and how they should view themselves in relation to society. Cultures also form their own ideas about what is important in life, and these ideas can vary widely. For example, the term *self-esteem*, so important in North American culture, is not even found in a number of languages. Clearly, people who live in a society that does not emphasize self-esteem are less likely than North Americans to spend their lives striving for it. Similarly, in North America and Western Europe, a person's goals and life path are often influenced by the culture's emphasis on autonomy and accomplishment, whereas in Asian cultures there is greater emphasis on contributing to a community and honouring one's family (Abdel-Khalek, 2016).

Some of the most comprehensive cross-cultural research has focused on personality development in individualist and collectivist cultures. As we observed in Chapter 1, most collectivist cultures consider the needs of the group more important than the needs of the individual. With this orientation comes heightened emphasis on the role of individuals within their family and on social relationships in general. In turn, individuals are more likely to strive to help maintain the social order and to exhibit humility in social interactions (Stellar et al., 2018; Fiske, 2018). Collectivist values are particularly found in African, Latin American, Asian, and Middle Eastern cultures (Cohen, Wu, & Miller, 2016).

In contrast, individualist cultures value individual achievement, freedom, and success. The self is seen as independent, and each individual is thought to possess a set of psychological qualities that are distinct from those of others. Unlike collectivist cultures, individualist cultures consider individual attainment more important than the needs and values of others. Indeed, competition between individuals is valued. Countries known for this type of structure are Canada, Great Britain, the United States, and Australia.

Cross-cultural psychologists have uncovered some interesting personality variations between collectivist and individualist cultures (McCrae, 2017; Church, 2016; Galinha et al., 2016). One large, multi-nation study found that people in collectivist cultures tend to score higher on measures of agreeableness, for example, while people from individualist cultures score higher on measures of extroversion and openness (Allik et al., 2017).

Happiness and success may also be defined differently from culture to culture. In collectivist societies, contentment is related to harmony in interpersonal relationships, and this emphasis affects behaviour. Interpersonal behaviours are tailored to the feelings and needs of others (Mesquita, Boiger, & De Leersnyder, 2016; Hitokoto & Uchida, 2015). A strong sense of reciprocity and a responsibility to return favours shapes personal styles, behaviours, life goals, and measures of success. In such a culture, a sense of accomplishment comes not from individual achievements but from strong commitment to family, community, or company.

In contrast, people in more individualist cultures are less constrained by a tightly knit social network and enjoy greater personal freedom. They value their privacy and place a premium on individual human rights. Interestingly, some studies have found that people in individualist cultures report greater happiness than those in collectivist cultures (Igarashi,

2016; Heine, 2015). At the same time, however, individualist societies have higher rates of divorce, homicide, and stress-related disease than collectivist ones (Beltrán-Velasco et al., 2020; Yip et al., 2015; Hughes, Schaible, & Gibbs, 2015).

People's sense of their own personalities also differs across cultures. Individuals in collectivist cultures, for example, do not use traits to describe themselves as often as those in individualist cultures. Studies have shown that when students are asked to complete the phrase "I am . . .," those from North America are more likely to answer using a personal trait (say, "I am friendly" or "I am honest"), while those from cultures with a collectivist orientation are more likely to describe themselves in a social manner (for example, "I am a member of the psychology department") (McCrae, 2017). In light of such findings, some have argued that Western personality measures, such as the Big Five superfactors, are of limited usefulness in studying behaviour in collectivist cultures (McCrae, 2017; Church, 2016). (See photos.)

The interplay of culture and personality is also evident when people move from one environment to another. As people become entrenched in a new cultural context, they typically absorb the norms and values of the society. Indeed, research has revealed that when individuals move from a collectivist culture to an individualist one, their personal and behavioural patterns change. One study, for example, looked at the personality traits of Chinese students who were enrolled in universities in North America (McCrae et al., 1998; Allik & Realo, 2017). Those students who had been in North America the longest, and had presumably been more exposed to Western culture, showed higher levels of extroversion and had personality profiles more similar to those of other North Americans.

Interestingly, some people who come from bicultural backgrounds seem to develop the ability to "frame switch"—that is, to change back and forth between cultural frameworks as they interpret experiences. This suggests that they may have internalized the belief systems of both cultures (Mesquita, De Leersnyder, & Jasini, 2017). It is not yet clear what implications frame switching has for the ties between culture and personality. This is, however, an important question as the world moves each day toward greater cultural integration.

Jupiter Images/Getty Images

Tokyo Space Club/Corbis Images

Different values, different personalities The different ways in which these business meetings are being conducted in North America and Japan reflect the different values and personalities at work in individualist and collectivist cultures. Goals and personal styles in an individualist culture emphasize striving for autonomy,

individual achievement, and high self-esteem. In contrast, those on display in a collectivist culture emphasize the community, cooperation, and honouring one's family.

Culture, Socio-economic Environment, and Personality

A key aspect of culture is the socio-economic environment. Even in the most prosperous nations, there are distinct differences in living conditions between those in the lowest and those in the highest income brackets. These differences have actually increased across the world in recent years (Hanushek et al., 2020; Chmielewski, 2019). Although the relationship between socio-economic conditions and personality traits has received relatively little attention, investigations conducted to date suggest that it is an important topic (Ayoub et al., 2018; Flensborg-Madsen & Mortensen, 2014). At the very least, it appears that living conditions have a direct impact on how and whether certain personality traits translate into behaviours.

For example, Annie Yessine of the National Crime Prevention Centre in Ottawa and James Bonta of Public Safety and Emergency Preparedness Canada (2009) examined the trajectories of delinquent Indigenous youth in Manitoba. Data from the study indicated that chronically high offending youth were more likely to live in impoverished and unstable circumstances, to engage in substance use, and to experience negative peer interactions, suggesting that disorganized environments interact with individual characteristics to increase risk. Indeed, other studies directly assessed the impulsivity of a population of adolescent males. The teens in the studies came from a mixture of backgrounds, from wealthy households to poverty-stricken neighbourhoods. Their socio-economic status was found to clearly link with the outcomes of individual differences in impulsivity. Among boys who lived in poor neighbourhoods, those who displayed high levels of impulsivity were much more likely to engage in delinquent behaviours than those who displayed low levels of impulsivity. In contrast, among boys from high socio-economic status neighbourhoods, behavioural differences between those with low and high impulsivity were negligible (Ray et al., 2016; Lynam et al., 2000). To explain these findings, the investigators reasoned that poor neighbourhoods produce many more triggers for delinquent acts, whereas community structures in affluent neighbourhoods may offer limited opportunities for antisocial activities (see photo). In short, particular personality characteristics will result in particular behaviours only if certain situational triggers also are in place.

Syldavia/iStockphoto

Socio-economic class, impulsivity, and behaviour **Research suggests that impulsive boys from poor neighbourhoods may be more likely to engage in delinquent behaviours than impulsive boys from wealthier communities.**

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

22. What personality differences between men and women have researchers identified?

23. How does social role theory explain these differences?

24. What are some of the primary differences between the values of collectivist and individualist cultures, and how do these differences affect personality?

25. How does the socio-economic environment affect personality?

What Do You Think? • Think about the personality traits of a number of people you know. Include people of different genders and different cultural or subcultural groups. Do personalities seem to differ more on a group level or on an individual level among these acquaintances? How would you explain your observation?

Personality Disorders

LEARNING OBJECTIVE 8

Define personality disorders, and describe some of the key features of these disorders.

Imagine that a friend of yours is telling you about their brother Tom's relationship with his girlfriend, Sarah. Your friend explains that early in the relationship Sarah was exuberant and very attentive to Tom. After a while Tom started talking about how he was finding it stressful that Sarah texted him almost constantly at all hours when they were apart, asking him what he was doing and if he still cared for her. In addition, if he spent time with other friends Sarah would quiz him about what they did and act quite upset that he may have been having a good time without her. When Tom told her to relax, she would either get angrier or would apologize profusely and promise to never do it again. Recently Tom had decided to move on from the relationship and had been struggling with an incessant series of texts, emails, and tearful phone calls from Sarah that varied from venomous rants to pleas for reconciliation. Tom's summary of the situation was that "she is schitzy . . . she is crazy!"

What does this description of relationship behaviour suggest to us about Sarah? Was she the victim of emotionally distressing circumstances? Or was her destructive behaviour the result of dysfunctional personal characteristics? It appears that Sarah's initial positive feelings and excitement about someone new in her life were invariably followed by a turbulent phase of emotional outbursts and an eventual falling out. As you will see in Chapter 15 on psychological disorders, we tend to treat disorders such as schizophrenia categorically in the sense that someone who meets the diagnostic criteria is diagnosed as "having" the disorder. (This is likely not what is going on for Sarah, and therefore Tom's descriptor of her as "schitzy" is misplaced.) However, psychologists and people in general do not believe that personality works that way. In terms of personality, we do *not* say that someone *has* extroversion. Rather, we say that they score high on the extroversion scale. What about Sarah? Does she have an extreme personality profile? She is certainly out there on neuroticism! This pattern suggests that Sarah may have a **personality disorder**, an inflexible pattern of inner experience and outward behaviour that causes distress or difficulty with daily functioning. Such patterns are enduring and differ markedly from the experiences and behaviours usually expected of people (APA, 2013). As we suggested earlier in this chapter, each of us has a distinct personality and specific personality traits. Yet, for most of us, this distinct personality is also flexible. We are affected by situational factors, and we learn from our experiences. As we interact with our environment, we try out various responses to see which are more effective. This flexibility is missing in people who have a personality disorder.

> **personality disorder** an inflexible pattern of inner experience and outward behaviour that causes distress or difficulty with daily functioning.

The American Psychiatric Association, in working on the latest edition of the *Diagnostic and Statistical Manual* (DSM-5) (APA, 2013), debated whether to approach personality

disorders as involving extremes on personality dimensions or, as it had in previous editions, as diagnostic categories like other disorder categories such as depression or schizophrenia. Despite substantial support for the dimension approach, the APA editorial committee decided to stay with personality disorder categories for now but to add study of a dimensional approach to personality disorders to the DSM-5's section on research needed and encouraged (Cloninger & Svrakic, 2016; Bach & Sellbom, 2016). We will discuss personality disorders in more detail in Chapter 15. Let's have a look at a couple of examples of the current categorical approach and then we will take a brief look at the alternative dimensional approach that fits better with the trait approaches to personality we have discussed in this chapter.

Personality disorders usually become evident during adolescence or early adulthood, although some begin during childhood (APA, 2013). There is no specific data on the rate of personality disorders in Canada, though a large-scale study by Jennifer Hensel and colleagues at the University of Manitoba looking at the incidences of disorders among people with contact with the law and their victims showed rates similar to the American data (Hensel et al., 2020). International data suggest that the rate is somewhere between 9 and 13 percent of the general population (Volkert, Gablonski, & Rabung, 2018; Gawda & Czubak, 2017; Tyrer, Reed, & Crawford, 2015). As in Sarah's case, the effects of a personality disorder can sometimes be so subtle that they are initially unnoticeable. It may take multiple encounters over time for the maladaptive symptoms to become recognizable. In the latest edition of its diagnostic manual (DSM-5), the American Psychiatric Association (APA, 2013) states that all personality disorders share four core features:

rigid, extreme, and distorted thinking patterns (thoughts);

problematic emotional response patterns (feelings);

impulse control problems (behaviour); and

significant interpersonal problems (behaviour).

Clearly, these symptoms have a significant impact on the individual's functioning in school, at work, and in social and romantic relationships (Hepp et al., 2017; Berenson et al., 2011; Mason & Kreger, 2010).

Based on Tom's description, Sarah appears to be emotionally volatile, particularly when it comes to her relationships. Especially in the early stages of a relationship, she tends to see the men in her life as "perfect," but they inevitably fall from grace. Sarah also appears to have a high sensitivity to feeling abandoned, which leads to emotional outbursts. She may even cut herself or cause some other harm as a way of dealing with that negative emotion. Her outbursts and moodiness are off-putting to her boyfriends and most others in her life. All these features suggest that Sarah may be displaying **borderline personality disorder**. Borderline personality disorder is characterized by severe instability in mood and self-concept, which in turn contributes to a high level of instability in relationships (APA, 2013). Borderline personality disorder is often thought of as an emotion dysregulation disturbance (Sherry & Whilde, 2008; Berenbaum et al., 2003; Linehan & Dexter-Mazza, 2008) and will be discussed further in Chapter 15.

borderline personality disorder a personality disorder characterized by severe

instability in emotions and self-concept and high levels of volatility.

Leah Hennel/Calgary Herald, reprinted with permission of The Calgary Herald

Disregarding others **Ponzi-schemer and fraudster Milowe Brost, from Calgary, Alberta, was sentenced to 12 years in prison for defrauding thousands of investors of more than $300 million.**

Individuals who might be generally described as sociopaths are categorized within the DSM-5 with **antisocial personality disorder**. These individuals, most of whom are male, show an extreme and callous disregard for the feelings and rights of others. They typically exhibit impulsivity, egocentrism, and recklessness, along with a superficial charm. Dishonesty and deceit are at the root of their relationships. Indeed, they often form relationships with the intent of exploiting others for material gain or personal gratification (see photo). Many are irritable, aggressive, and quick to start fights, and a large number commit criminal acts (APA, 2013). A large study by Dan Offord (1933–2004) at McMaster University suggests that approximately 1.7 percent of the Canadian population shows signs of antisocial personality disorder at any one time (Offord et al., 1996). Another study by

Rodger Bland in the department of psychiatry at the University of Alberta suggests that the incidence of this disorder is about 3.7 percent (Bland, Orn, & Newman, 1988). Moreover, cross-cultural research has shown that similar antisocial patterns of symptoms are found in both Eastern and Western cultures (Zoccolillo et al., 1999).

> **antisocial personality disorder** a personality disorder characterized by extreme and callous disregard for the feelings and rights of others.

Many theorists have attempted to uncover the origins of personality disorders, and have highlighted factors such as the roles of biological predispositions, early experiences of abuse and neglect, and the pressures of poverty or otherwise harsh social environments (Morgan & Zimmerman, 2018; Newman et al., 2016; Arens et al., 2011). (See Psychology Around Us 12.1.) We will discuss borderline and antisocial personalty disorders and briefly discuss the other eight personality disorders that are defined categorically within the DSM-5 in Chapter 15.

There is broad interest in a dimensional approach to personality disorders (Hopwood et al., 2018; Herpertz et al., 2017). At its core, this approach is based on the idea that personality disorders involve stable behaviour patterns that reflect extreme ends of personality dimensions. One approach, taken by Delroy Paulus at the University of British Columbia and Paul Trapnell at the University of Winnipeg, involves examining what they call dark traits within personality. The initial dark triad included narcissism, Machiavellianism, and psychopathy (Paulhus, 2014; Furnham, Richards, & Paulhus, 2013; Paulhus & Williams, 2002) and was expanded into a dark tetrad by including sadism (Međedović & Petrović, 2015). These personality dimensions are described as subclinical, which means they describe behavioural tendencies among people in the general population that would not necessarily predict that people scoring at the extremes would necessarily meet the diagnostic criteria for a personality disorder in the categorical sense. If you dare, or are curious, you can find out how you score on a measure of the dark triad traits here: https://openpsychometrics.org/tests/SD3/. The dark traits approach has been shown to be predictive of self-identifying as an online troll, with sadism scores being the strongest contributor to the results (Duncan & March, 2019; Buckels et al., 2019; Buckels, Trapnell, and Paulus, 2014). The dark traits have also been shown to be associated with violent video game preferences (Greitemeyer, 2015) and tendencies to use Facebook to spy on others (Stiff, 2019; Craker & March, 2016).

12.1 Psychology Around Us

School Shootings and Videogames

On December 6, 1989, one of the deadliest shootings in Canadian history occurred at Montreal's École Polytechnique, when a young man killed 14 women students, injured 10 other women and four men, and then shot himself. The gunman claimed that feminists had ruined his life. Attempts to interpret motives for this and other shootings led researchers to focus on issues of violence against women (Fluehr-Lobban & Billson, 2013; Mancini Billson, 2005), as well as the role of previous child abuse and its relationship to violent behaviour (Young, Michael, & Smolinski, 2019; Denmark et al.,

2005), the role of bullying and victimization (Brown, 2018; Haner & Lee, 2017; Reid & Sullivan, 2009), the role of violence in the media, and the socio-political roles of poverty and isolation in society (O'Grady, Parnaby, & Schikschneit, 2010). The aftermath of the shootings at the École Polytechnique contributed to the passage of the Firearms Act in 1995, leading the way toward more stringent gun control laws in Canada (Rathjen & Charles, 1999). Investigators have also discovered that most school shootings are premeditated and carefully planned (Matt, 2017; Robertz, 2007).

For its part, the media has regularly tied school shootings, such as the American shootings at Columbine high school, to the playing of videogames—the two students who orchestrated the Columbine killings were, for example, avid players of Doom. But, it turns out that the behaviour of student-killers is not so easily explained. Three years after Columbine, the American Secret Service and the Department of Education published a joint report that looked at 37 school shootings over the past three decades. They concluded that only 12 percent of the school shooters had any interest in videogames (Vossekuil et al., 2002).

If videogames are not a major factor in most school shootings, what are the causes of these violent outbursts? Recent studies of the relationship between school shootings and videogames have found that family violence is more of a risk factor than fictional violence (Duplechain & Morris, 2014; Flannery, Modzeleski, & Kretschmar, 2013). Low self-esteem, depression, and antisocial personality patterns are also factors. In addition, as we observed earlier in this book, adolescent shooters are often the victims of bullying or rejection, and some fantasize for quite a while about revenge for perceived offences (Brown, 2018; Haner & Lee, 2017).

In light of these school shootings and other such incidents, reports (Leavitt, Spellings, & Gonzales, 2007; Cawood & Corcoran, 2019) recommend increased awareness of the warning signs of potential attacks, such as a student describing plans to hurt others on a website. The hope is that identifying and addressing problems early on may prevent students with mental health problems from reaching a point where there is no turning back.

More formally, the committee that was considering personality disorder related revisions to the Diagnostic and Statistical Manual spelled out what they called an alternative model of personality disorders (AMPD). A major concern with the categorical approach to personality disorders, noted above and discussed further in Chapter 15, was that many people who present with some sort of personality disorder end up in a catch-all diagnostic category called personality disorder—not otherwise specified. By taking a dimensional approach, the AMPD is intended to sort out this category and also shine some light on what contributes to the various personality disorder profiles (Waugh et al., 2017). **Table 12.4** shows the two main personality disorder criteria within the AMPD. Criterion A reflects the realization that all personality disorders share levels of general dysfunction at the level of the self (dysfunctions in identity and self-direction) and interpersonally (dysfunctions in empathy and intimacy). Criterion B reflects the dimensions of individual variation seen within personality disorders and consists of five trait domains, each of which is defined by a number of more specific facets or narrower traits. Besides using the term "traits," how are these personality disorder trait domains related to general personality? Well, they reflect

particularly extreme aspects of healthy personality traits described within the Big Five model, with negative affectivity reflecting extreme instability, detachment reflecting extreme Introversion, antagonism reflecting extreme disagreeableness, disinhibition reflecting extremely low conscientiousness, and psychoticism reflecting extreme openness to experience. There is a great deal of work being done to develop and validate scales for applying the AMPD. Candidate inventories to watch as work proceeds are the Personality Inventory for the DSM-5 (Krueger, Watson, & Widiger, 2020; Wright & Krueger, 2018; Krueger et al., 2012), the Personality Assessment Inventory (Busch, Morey, & Hopwood, 2017; Hopwood et al., 2013), and the General Personality Pathology Scale (Williams, Scalco, & Simms, 2018; Morey, 2017). These efforts to link personality disorders to a dimensional approach to personality will likely produce some very interesting results in the coming years.

TABLE 12.4

The Major Personality Disorders
Source: Based on American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders 5*. Washington, DC: APA.

Marked by Odd or Eccentric Behaviour
Paranoid: Exaggerated suspicion and distrust of others; assumption that others' motives are hostile; highly guarded and emotionally withdrawn
Schizoid: Detachment from social relationships; flat emotional expression; cold or indifferent to others
Schizotypal: Behaviour that is odd or peculiar; unusual cognitive or perceptual experiences; acute discomfort with close relationships
Involve Dramatic or Emotional Behaviour
Antisocial: Extreme disregard for others; relationships are dishonest, deceitful, and exploitive; typically impulsive and reckless
Borderline: Severe instability in emotion and self-concept; impulsive and self-destructive behaviour
Histrionic: Excessive need to be noticed and be the centre of attention; emotions shallow and changeable; engagement with others superficial
Narcissistic: Characterized by high degree of self-interest and self-importance; callous attitude toward others
Characterized by High Levels of Fear and Anxiety
Avoidant: Extreme feelings of inadequacy; avoidance of social activities; inhibited personal relationships; hypersensitive to criticism
Dependent: Excessive need to be cared for by others; clinging and submissive behaviour; difficulty making decisions
Obsessive-compulsive: Preoccupied with perfectionism and control at the expense of flexibility or enjoyment; excessive devotion to work and productivity

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

26. What is a personality disorder?

27. What do all personality disorders have in common?

28. What are some differences between the categorical and dimensional approaches to personalty disorders?

What Do You Think? • Personality disorders are popular subjects of fiction. Think about films or television programs that you have seen, and try to find examples of characters who may be displaying personality disorders.

Summary

The Psychodynamic Perspective

LEARNING OBJECTIVE 1 Summarize the main ideas of the psychodynamic view of personality development.

Personality refers to the unique characteristics that account for enduring patterns of inner experience and outward behaviour.

Sigmund Freud's psychoanalytic theory of personality depended to a large extent on his ideas about the conscious and unconscious mind. Most of the content of our minds, in Freud's view, is in the unconscious.

Freud proposed three central forces in personality development: the id, the ego, and the superego.

In Freud's view, personality develops as children pass through a series of psychosexual stages. Each stage is characterized by strong conflicts between the id, the ego, and the superego. Failure to resolve these conflicts can result in neuroses.

Conflicts result in anxiety, and Freud believed that we use unconscious tactics called defence mechanisms to protect ourselves from this anxiety.

Other psychodynamic theories include those of Alfred Adler, Carl G. Jung, and Karen Horney.

The Humanistic Perspective

LEARNING OBJECTIVE 2 Describe the humanistic theories of Abraham Maslow and Carl Rogers.

Humanistic theorists, including Abraham Maslow and Carl Rogers, emphasized people's basic goodness and their ability to fulfill their potential.

Maslow proposed that personality arises from people's striving to meet their needs. Human needs are arranged hierarchically, with self-actualization at the top level.

Rogers based his theory of personality on his ideas about the importance of self-concept. He believed that children need unconditional positive regard to develop healthy self-concepts.

The Trait Perspective

LEARNING OBJECTIVE 3 Summarize the leading trait theories, and describe how the five-factor theory has evolved from the work of Gordon Allport and Hans Eysenck.

Personality traits are tendencies to behave in certain ways that remain relatively constant across situations. Trait theorists such as Gordon Allport and Hans Eysenck first proposed that central traits affect a broad range of behaviour.

Allport conducted detailed case studies that sought to reveal the unique collection of traits at play for each individual.

Eysenck, using factor analysis, identified three personality superfactors: extroversion, neuroticism, and psychoticism.

Other trait theorists proposed the five-factor theory, which identified five major trait categories: agreeableness, extroversion, neuroticism, conscientiousness, and openness to experience.

Although traits play an important role in behaviour, they can be inconsistent over time and across different situations.

Personality Assessment

LEARNING OBJECTIVE 4 Describe the two major types of personality tests, and give examples of each.

Personality inventories are questionnaires that require individuals to respond to a series of true–false or agree–disagree statements designed to measure various aspects of personality.

Two widely used personality inventories are the *Minnesota Multiphasic Personality Inventory 2 (MMPI-2)* and the *Revised NEO Personality Inventory (Neuroticism, Extraversion, Agreeableness, Conscientiousness, and Openness to Experience*) (*NEO-PI-R*). The MMPI-2 is typically used to assess abnormal personality characteristics and inclinations. The NEO-PI-R evaluates traits associated with the five-factor theory of personality.

Projective tests are intended to tap into people's unconscious minds by having them interpret ambiguous stimuli. In the case of the Rorschach Inkblot Test, the stimuli are inkblots. In the case of the Thematic Apperception Test (TAT), they are black-and-white drawings.

The Situationist and Interactionist Perspectives

LEARNING OBJECTIVE 5 Describe and differentiate the situationist and interactionist

views of personality.

Situationism holds that behaviour is governed primarily by the variables in a given situation rather than by internal traits. The behaviourist B. F. Skinner could be said to have viewed personality from this perspective.

Interactionism focuses on interactions between persons and situations. Albert Bandura's social-cognitive theory is an example of interactionist theory. In Bandura's view, the environment, internal mental events, and behaviour all interact to affect behaviour through the process of reciprocal determinism.

Biological Foundations of Personality

LEARNING OBJECTIVE 6 Discuss the heritability of personality traits and some of the neural systems that may be involved in the expression of personality.

Twin studies, such as the Minnesota Study of Twins Reared Apart, suggest that many personality traits have strong genetic links.

Certain brain structures, neurotransmitters, and hormones have been associated with personality variables.

In interpreting links between genes, physiological factors, and personality, it is important to remember that the relationships are complex and multidirectional.

Differences in Personality

LEARNING OBJECTIVE 7 Explain how gender and cultural differences can affect personality.

Research has found many more similarities than differences between men's and women's personalities. Nevertheless, some consistent differences have been identified.

Socio-cultural factors are thought to play an important role in gender differences in personality. According to social role theory, for example, boys and girls develop different behaviours and skills based largely on the division of labour between the sexes and the resulting differences in gender role expectations.

Cross-cultural research into personality has focused on personality development in individualist and collectivist cultures. Some traits observed in these cultures reflect differing cultural values.

The relationship between socio-economic conditions and personality traits has received relatively little attention. However, the investigations that have been conducted suggest that at the very least, living conditions have a direct impact on how and whether certain personality traits translate into behaviours.

Personality Disorders

LEARNING OBJECTIVE 8 Define personality disorders, and describe some of the key features of these disorders.

A personality disorder is an inflexible pattern of inner experience and outward behaviour that causes distress or difficulty with daily functioning.

The American Psychiatric Association uses a categorical approach to personality disorders such as borderline and antisocial personalty disorders but is investigating a dimensional approach.

Key Terms

antisocial personality disorder

borderline personality disorder

defence mechanisms

denial

ego

five-factor model

id

interactionism

interpersonal circle

lexical hypothesis

neurosis

personality

personality disorder

personality inventory

personality traits

personality trait model

phrenology

positive psychology

projective test

psychosexual stages

repression

self-actualization

self-concept

situationism

social role theory

socially desirable responding

superego

superfactor

unconditional positive regard

Self-Study Questions

Multiple Choice

1. In Freud's view, personality forms as the result of the struggle between

a. biological drives and intellectual abilities.

b. conscious and unconscious processes.

c. primal needs and social or moral restraints.

d. the individual and other people.

2. Maslow believed that we can learn the most about the human condition by

a. creating an atmosphere of openness, honesty, and freedom from judgment.

b. paying attention to the unconscious symbols in our collective ancestry.

c. studying normal people.

d. studying those with psychological problems.

3. A person who follows rules, is dependable, and checks her work carefully is probably high in which of the Big Five personality traits?

a. Agreeableness

b. Conscientiousness

c. Extroversion

d. Openness

4. All of the following statements about personality traits are true except

a. Between three and five of the Big Five personality traits can be found across all cultures.

b. Traits are not always stable across situations.

c. Traits are powerful and difficult to disguise.

d. Traits are stable and consistent over time and across situations.

5. According to Skinner, what we call personality is simply consistency of what tendencies?

a. Environmental

b. Latent

c. Response

d. Situational

6. The Minnesota Study of Twins Reared Apart found that

a. both family environment and genetics predicted psychological similarity equally well.

b. family environment was more important than genetics in predicting psychological similarity.

c. genetics was more important than family environment in predicting psychological similarity.

d. the interaction between genes and environment prevented the researchers from drawing firm conclusions.

7. According to research, people who score high on Clark and Watson's disinhibition dimension are more likely to

a. be morning people.

b. feel anger, contempt, and guilt.

c. lead active lives and exhibit enthusiasm.

d. perform more poorly at work and engage in risky activities.

8. In collectivist cultures, happiness and a sense of accomplishment tend to come from

a. harmony in interpersonal relationships.

b. one's achievements at work.

c. personal freedom and privacy.

d. the amount of money one makes.

9. Personality disorder is best defined as being

a. an inflexible pattern of inner experience and outward behaviour that causes distress or difficulty with daily functioning.

b. characterized by a high degree of self-interest and a high, often unrealistic, degree of self-importance.

c. characterized by extreme and callous disregard for the feelings and rights of others.

d. characterized by severe instability in emotions and self-concept and high levels of volatility.

10. All of the following are characteristics of projective tests except that they

a. have a validity scale built into them that guards against socially desirable responding.

b. have problems with reliability.

c. include the Rorschach and the TAT.

d. rely on clinicians' judgment for analysis.

Fill-in-the-Blank

1. According to Freud, the _____ operates on the reality principle and the _____ operates on the pleasure principle.

2. In Freud's theory, the _____ stage of psychosexual development includes identification with the same-sex parent.

3. Rogers claimed that in order to develop a positive self-concept, we need to accept ourselves and to receive _____ from important people in our lives.

4. A person who frequently experiences negative emotions is probably high on Eysenck's superfactor of _____.

5. The finding that different people respond to the same reinforcer in different ways is a problem for the _____ view of personality, leading most researchers to prefer an interactionist approach.

6. Although research proved it to be incorrect, Gall's theory of _____ was important to our later understanding that particular brain areas have particular functions.

7. Some psychologists believe that inhibited children may have an overactive _____, a part of the brain important to the experience of negative emotion.

8. According to _____ theory, the gender differences typically seen in skills and behaviour are largely due to the division of labour between men and women.

9. A person who is charming and manipulative and who does not feel guilty when he hurts others' feelings or takes advantage of them is likely to have _____ personality disorder.

10. Test items that are built into a personality assessment to control for social desirability responding are referred to as _____ items.

CHAPTER 13
Social Psychology

ERIC THOMAS/Getty Images

CHAPTER OUTLINE

Social Cognition: Attitudes

LEARNING OBJECTIVE 1 Explain how attitudes form and change and what role they play in behaviour.

Social Cognition: Attributions

LEARNING OBJECTIVE 2 Discuss how people make attributions to explain their own behaviour and the behaviour of others.

Social Forces

LEARNING OBJECTIVE 3 Describe the power of conformity and obedience in shaping people's behaviour.

Social Relations

LEARNING OBJECTIVE 4 Review major concepts in the areas of group dynamics, helping behaviour, aggression, and interpersonal attraction.

Social Functioning

LEARNING OBJECTIVE 5 Describe the major findings of social neuroscience about regions of the brain particularly important to our social functioning.

To say 2020 was an interesting year would be a hysterical understatement. It is no small undertaking to reflect on your own experiences with the massive social psychology experiment defined by the global coronavirus pandemic and the outpouring of concern over issues of racism, racial justice, and policing that were raised by several incidents, such as the deaths during police incidents of George Floyd in Minneapolis and of Indigenous

Canadian woman Chantel Moore in Edmundston, New Brunswick. In fact, the situation was not an experiment of any sort as it involved the entire population and was radically changing our lives.

In relation to COVID-19, think back to May 2020 and to the challenges of social isolation, social distancing, mask wearing, working or studying or simply being unemployed from home, communicating, socializing, and, perhaps, socially drinking via Zoom. We were all trying to come to terms with the wide array of social, economic, health, and personal uncertainties about the immediate, near-, and far-term futures. Hopefully, things are better for you now as you read this than they were then, though being only able to hope for that to be true was and likely still is a part of our uncertainties. Many of the direct stresses and anxieties associated with the pandemic will fit clearly into the types, categories, and responses to stress that will be discussed in Chapter 14. However, there are many aspects of our pandemic experiences that were linked to indirect, harder-to-see or to understand stressors. For example, social distancing—having to keep at least two metres away from someone—is simple to understand but how we spatially manage ourselves when we are out in the world is based on sociocultural norms that we learned and automated years ago when we were young. We knew we had to keep away from others, but doing so felt weird.

In the same vein, Zoom and other videoconferencing platforms made it easy for us to meet in virtual "face-to-face" fashion, but there are may ways in which a video session is not the same as face-to-face interaction. Eye contact, an important part of communication, is difficult because to have it appear to happen, you have to look into your camera instead of into the image of the face of the person you are talking to. A lot of the body language we use quite automatically to let us know whose turn it is to talk or who should respond to something someone else says is either unclear or entirely unavailable in a video call. As well, all sound in a video call shares the same data channel and so all directional cues are lost. Further, if two people happen to speak at once, the limited sound channel typically selects whichever speech stream was started first, making it hard to even hear, let alone sort out what the other person is saying. None of these things matter very much in a formal business meeting, where who is supposed to be speaking when and about what is usually laid out in advance in an agenda. In social video calls, however, they can add significantly to the information processing and social interpretation demands of the experience. Videoconference fatigue (see photo) is real and arises from the ways that these sessions limit or eliminate our access to many sources of social information we learned about and came to automatically monitor and react to years ago. Having to do without them or to find ways to replace the lost social information is stressful in ways that we are not fully aware. So, as if all the directly stressful aspects of the COVID-19 pandemic were not more than enough, we are also carrying the impacts of a broad array of indirect stressors, meaning that our overall social and personal stress levels are actually significantly higher than we are acknowledging.

What about having to wear masks (see photo)? Health science aside, our old social norms about masks usually involved self-protection, perhaps from germs or from being identified while we are trick-or-treating or robbing a bank. With COVID-19, health science suggested that we should wear masks in order to protect other people from our spit and breathing or coughing vapours. The incompatibility of these two sets of social norms, old and new, created some resistance to wearing masks—more so in the United States. Hopefully by the

time you read this, these conflicts have been sorted out on both sides of the border, but as we write this, it is yet another thing adding to stress.

Andrey_Popov/Shutterstock.com

Matthew Horwood/Getty Images

Pandemic related shifts in social norms Left, before the COVID-19 pandemic few knew about or used Zoom. Now Zoom fatigue is common. Right, tensions tied to old social norms regarding mask wearing sometimes boiled over.

Social psychologists study, among other things, the broad array of sources that we draw upon for information as we engage in social interaction. They can help us to see more clearly the direct and not so direct social changes and social norm shifts that escalated our uncertainty and stress levels through 2020.

In the midst of the COVID-19 outbreak, the issues of racism and police violence were broadly taken up both in terms of the #BlackLivesMatter movement following the death of George Floyd at the hands of police in Minneapolis and similar issues among Indigenous peoples following the death of Chantel Moore on June 24 in Edmundston, New Brunswick. At issue are matters of overt racism and, most importantly, matters of structural or implicit racism that have supported racially linked imbalances favouring Whites or settlers over people of colour or of Indigenous heritage in terms of access to resources, education, jobs, and basic safety. The over-representation of Blacks in American prisons (Bronson & Carson, 2019) and Indigenous people in Canadian prisons (Campbell & Wellman, 2020), the over-representation of both groups in the lower socio-economic class (Hajizadeh et. al, 2018; Quillian, 2017), and their significant over-representation among those who died during interactions with the police are key markers of systemic racial issues. In Canada, over the past 20 years, Indigenous people have accounted for 16 percent of those killed by the police while making up only 4.2 percent of the population, while Blacks accounted for 8.6 percent of such deaths while making up 2.9 percent of the population (Council of Canadian Academies, 2019). In the first half of 2020, the number of individuals killed in encounters with police was at 30, which is the average *annual* total across the previous 10 years (Flanagan, 2020). Calls to defund the police are not aimed at punishing police but rather at recognizing that the word “order” in the typical police mandate of law and order is premised upon a definition of order that is skewed along racial lines and that parts of police funding would be more effectively directed toward better means of addressing mental health and other needs than by police deployment. As well, calls for justice for missing and murdered Indigenous Canadian women.

What do you make of the concept of systemic racism? Is it different than a lot of individuals holding personal racist attitudes and if so, how is it different and how might we, or *must* we, address it? Social psychology may provide some useful insights here too. Social psychologists devote themselves to the study of human interconnectedness. Unlike many areas of psychology that focus on individual difference, such as personality or atypical development, social psychology is based on the belief that "it is not so much the kind of person a man is, as the kind of situation in which he finds himself that determines how he will act" (Milgram, 2004, p. 101).

We might think of social psychology in a general way as the scientific study of how people are affected by other people. This informal definition covers considerable territory. Many aspects of an individual's functioning may be affected by others—thoughts, feelings, and behaviours may each reflect the influence of the social environment. Moreover, the influence of others may be direct or indirect.

Given the many ways in which people affect one another, the pioneering psychologist Gordon Allport (1954) offered a more detailed definition of social psychology that is embraced by most people in the field. That is, **social psychology** seeks to understand, explain, and predict how our thoughts, feelings, and behaviour influence and are influenced by the actual, imagined, or implied presence of others (Allport, 1985).

> **social psychology** an area of psychology that seeks to understand, explain, and predict how people's thoughts, feelings, and behaviours are influenced by the actual, imagined, or implied presence of others.

Which pieces of this definition should social psychologists focus on? Many social psychologists have concerned themselves with **social cognition**—how people perceive and interpret themselves and others in their social world. They have examined, for example, the attitudes people hold and the attributions that people make. Other social psychologists have paid more attention to social forces and social interactions. We will discuss each of these areas on the following pages, and examine what happens in the brain during social functioning.

> **social cognition** the way in which people perceive and interpret themselves and others in their social world.

Social Cognition: Attitudes

LEARNING OBJECTIVE 1

Explain how attitudes form and change and what role they play in behaviour.

There are few things in our world that we do not evaluate in some form or another. On some evaluations, people tend to agree. For example, most people believe that natural disasters (wildfires) are bad, that horror movies are scary, and that babies deserve love. On other topics, people are more divided—such as the proper role of government in people's

lives, the best ice cream flavour, and the advisability of legalizing drugs. Psychologists refer to our relatively stable and enduring (within individuals) evaluations of things and people as **attitudes** (Morin et al., 2015; Smith & Ratliff, 2015; Howell, 2014; Noels, Kil, & Fang, 2014).

attitudes relatively stable and enduring evaluations of things and people.

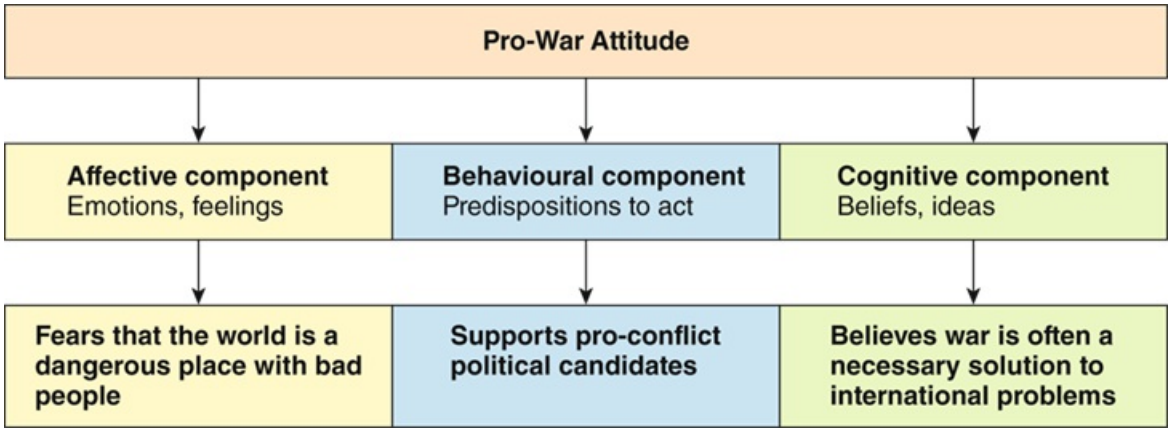


FIGURE 13.1 The ABC model of attitudes

According to the **ABC model of attitudes**, attitudes have three components, as shown in **Figure 13.1** (Jain, 2014):

The *affective* component—how we feel toward an object.

The *behavioural* component—how we behave toward an object.

The *cognitive* component—what we believe about an object.

ABC model of attitudes a model proposing that attitudes have three components: the affective component, the behavioural component, and the cognitive component.

Before the attacks on New York and Washington on September 11, 2001 when two planes were flown by terrorists into the World Trade Center north and south towers in New York city and one was flown in to the Pentagon, many North Americans held the attitude that their everyday world was safe from terrorism. They felt secure (affective component), went to work each day confident that terrorism would not touch their lives (behavioural component), and believed they were safe (cognitive component) (Ciuk, 2016; Steele, Parker, & Lickel, 2015). While many believe that the American response was generally disproportionate to the actual level of threat (Mueller & Stewart, 2012), general surveys of Canadians indicate that most feel generally safe with 94 percent reporting satisfaction with their safety in 2004, 93 percent in 2009 (Statistics Canada 2009) and 88 percent in 2014 (Perreault, 2017). Nevertheless, attitudes based on a fear of "other" (a phobia known as xenophobia) is a factor in hate crimes worldwide (Perry, 2016). Canada is also affected; hate crimes contribute to the number of violent crimes committed in Canada each year. The General Social Survey on Victimization (Allen & Boyce, 2013) indicated that 5 percent of reported incidents (almost 399,000 incidents) were deemed to have been motivated by

hate (65 percent due to race, 30 percent due to age, 22 percent due to religion, and 11 percent due to sexual orientation). Perhaps 5 percent seems a negligible number, but to the almost 400,000 people affected by hate-fuelled violence yearly, the numbers are frightening. But attitudes can change. We will explain the mechanisms by which attitudes change later in this section, but first, let's discuss how attitudes form in the first place.

Attitudes

Early in life, parents play a major role in shaping children's beliefs and opinions about things and people (Hill, Burrow, & Sumner, 2016; Simpkins, Fredricks, & Eccles, 2012). As we observed in Chapter 4, children are socialized when they acquire beliefs and behaviours considered desirable or appropriate by the family to which they belong. You are reading this textbook right now because you have been socialized in a number of ways—perhaps to believe in the value of a post-secondary education or the need for hard work to achieve your goals. This socialization may have occurred by direct transmission (your parents lecturing you about these values) or in subtler ways (Grusec & Hastings, 2014). Perhaps your mother or father praised you for your grades or punished you for not doing your homework. Over time, you might generalize these individual experiences into an overall attitude about the value of what you are doing.

Jose Luis Peleaz/Blend Images/Corbis

Shaping attitudes **Many school-age children today support recycling. What influences in the media and the general culture may have helped to shape this child's attitude?**

As children mature, their peers, their teachers, and the media also begin to significantly influence their attitudes (Bukowski et al., 2015; Prislin & Crano, 2012. (See photo.) Recall that in vicarious learning, children observe their classmates and take note of the rewards and punishments those students experience based on their behaviour. If a child sees a classmate rejected by the rest of the class for making disparaging remarks about a particular ethnic group, for example, the child may develop an attitude that such remarks are inappropriate and unacceptable. Similarly, seeing a favourite television character get whatever he wants by bullying people might foster an attitude that aggression is an acceptable way to achieve one's goals. Thus children learn attitudes in similar ways to the way they learn about other aspects of the world (Verkuyten & Thijs, 2013). Social Media also plays a role in how children (and everyone else) connect with their peers and social groups where FOMO plays a central role. What is FOMO? Well you can find out in Positive Psychology 13.1.

How Do Attitudes Change?

In addition to outside influences, we are also, of course, instrumental in shaping our own attitudes; that is, in addition to outside influence, the self is also a key source of attitude change. Such self-generated thought can have an important impact on our attitudes (Petty & Briñol, 2015). Research shows that just thinking about something makes it more significant and important to a person and explains, at least in part, why attitudes tend to become more extreme over time even when there is no additional exposure to outside information. Proponents of this phenomenon have dubbed it the *mere thought effect* (Tesser, 1978). They suggest that when people have more time to think about something, they generate more attitude-consistent thoughts and these thoughts serve to polarize (i.e., make more extreme) the attitude associated with them. However, Clarkson and associates (2011) argue that polarization of an existing thought is not due simply to additional thought; instead, they argue that people become more confident in their attitudes and thoughts as they marshal more attitude-consistent thought. Can such self-generated attitudes be changed?

13.1 Psychology Around Us | Positive Psychology

Combatting FOMO (Fear of Missing Out)

We've all experienced some level of FOMO anxiety (fear of missing out), whether it be feeling like we missed out on something when checking a Snapchat streak, Instagram, TikTok, or text messages. The phenomenon that encompasses FOMO is not new. Indeed, the human need to belong is a fundamental drive that is likely tied to how our ancestors survived in the distant past. With our current technology, however, it's been magnified in ways we couldn't have predicted even 15 years ago.

Increasingly, social media is becoming the defining way for people to feel connected to their friends, as opposed to getting together in-person—especially during the

lockdowns due to COVID-19. People with lower self-esteem are more likely to seek peer approval through social media and experience a greater degree of FOMO (Dogan, 2019). Researchers have found that increased social media activity does not provide a sense of enhanced social connection; rather, those who used social media more often were more likely to report a decreased sense of social connection (Roberts & David, 2020). Further, other studies have shown that adolescents with more social media engagement were more likely to report symptoms of inattention, ADD, anxiety, and depressive symptoms than those with more limited social media access (Barry et al., 2017).

There is some good news, however, for decreasing the anxiety and loneliness that can go along with social media and FOMO. One study of university students (Hunt, Marx, Lipson, & Young, 2018) found that limiting the use of three top social media platforms to 10 minutes per day (each) resulted in significant reductions in loneliness and depression over the three-week course of the study. Anxiety was also reduced over the baseline, as was FOMO, which led researchers to conclude that self-monitoring behaviour that limits time spent on these platforms can be beneficial to reducing anxiety and FOMO. In Chapter 9 we introduced the concept of metacognitions. Recent work suggests that creating positive metacognitions about social media may decrease FOMO and help decrease problematic social media use and its effects on our sense of self-esteem and self-worth (Casale, Rugai, & Fioravanti, 2018). While social media is here to stay, it's important to be aware of its effects on FOMO and to try to maintain our positive metacognitions and in-person connections.

Pixabay

Social media is here to stay However, maintaining our in-person social connections is an important way to avoid FOMO.

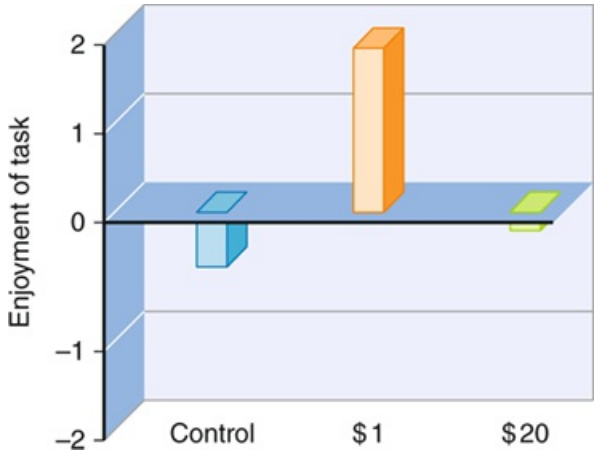


FIGURE 13.2 Cognitive dissonance After describing a boring task as fun, participants in Festinger and Carlsmith's study were asked to rate their own enjoyment of the task on a scale of 25 to 15. Those paid $1 ($8.50 today) for praising the task rated the task as more enjoyable than those paid $20 ($170 today) for praising it.

Source: Adapted with permission of John Wiley & Sons, Inc., from Kowalski, R., & Westen, D. (2009). *Psychology* (5th ed.). Hoboken, NJ: Wiley, p. 614; based on Festinger, L., & Carlsmith, J. M. (1959). Cognitive consequences of forced compliance. *Journal of Abnormal and Social Psychology, 58*, 203–210.

Once we have internalized a particular attitude—that is, once we have made it our own—how rigid and long lasting is that attitude? Can people experience a change of heart? In a classic social psychology experiment in the late 1950s, researchers Leon Festinger and J. Merrill Carlsmith (1959) demonstrated that when we are subtly manipulated into doing or saying something that is contrary to our private attitudes, we often change our attitudes to match the new action or statement.

In their study, Festinger and Carlsmith had research participants engage in a number of repetitive and boring tasks, such as spending an hour slowly turning square pegs on a board or adding spools to a tray and then removing them. After the tasks were done, the experimenters told the participants that the experiment was over and that they would be allowed to go home shortly—but in truth the experiment had just begun! Each participant was next told that a new group of individuals would soon arrive—individuals who would be performing the same tedious tasks but would be told ahead of time that the tasks were actually "fun" and "intriguing." The experimenter further asked each participant to help out by describing the upcoming tasks as fun and exciting to one of the new individuals. (All of the new individuals were in fact *confederates*. Confederates are people who are collaborators with the experimenters and are acting a part. In experiments where confederates play a role, participants believe the confederate to be the actual person they are pretending to be.) In spite of having found the task to have been really boring in almost all cases, the participants agreed to tell the new individuals that participating in the task was an enjoyable experience. Prior to meeting with the waiting "student" (recall this was actually a confederate), some of the participants were told they would be paid $1 (or about $8.50 today—a small amount of money) for helping out in this way, while others were told

they would receive $20 (about $170 in today's dollars).

After presenting the positive spin on the tedious tasks to the new individuals, the participants were then asked by yet another confederate presented as conducting a research experience survey for the psychology department to evaluate the experiment and to say how enjoyable they themselves actually believed the tasks to be. This was, in fact, Festinger and Carlsmith's (1959) central area of interest. Many of the participants paid $1 for "talking up" the tasks reported the tasks to be most enjoyable, whereas those who had been paid $20 were much less likely to report the task as enjoyable (see **Figure 13.2**).

How could participants come to find the mind-numbing tasks of this study enjoyable? Why did those paid less money to convince someone else that the tasks were enjoyable find the tasks *more* enjoyable than those paid more money to do so? Theorists have offered two possible answers to these questions.

Cognitive Dissonance Theory

Festinger (1957) proposed that when we hold two contradictory beliefs, or when we hold a belief that contradicts our behaviour, we experience a state of *emotional discomfort*, or **cognitive dissonance**. This state is so unpleasant that we are motivated to reduce or eliminate it. One way of removing dissonance is to modify our existing beliefs (Gawronski, 2012). In Festinger and Carlsmith's (1959) study, cognitive dissonance theory would hold that the conflict between the participants' initial attitudes about the tasks (that the tasks were boring and trivial) and their later behaviour (telling someone that the tasks were enjoyable) resulted in cognitive dissonance, and this unpleasant state motivated them to change their attitudes about the tasks in positive directions (that is, to believe they actually did enjoy the task, or at least that they found it less unpleasant).

> **cognitive dissonance** a state of emotional discomfort people experience when they hold two contradictory beliefs or hold a belief that contradicts their behaviour.

But what about the differing results for the participants in the $1 condition and those in the $20 condition? According to dissonance theory, the participants in the $20 condition experienced less dissonance because they had sufficient justification for their behaviour. Since they were well paid to say that the tasks were enjoyable, they could tell themselves, "I said the experiment was fun because I got quite a lot of money for saying it." (Remember that $20 was worth over eight times more in the late 1950s than what it is worth today.) Thus, these participants experienced little or no discrepancy between their attitudes and their behaviour. In contrast, those who received only $1 for their positive statements had insufficient justification for their behaviour and so experienced a marked discrepancy and uncomfortable feelings of dissonance. These participants managed to reduce the uncomfortable feelings by modifying their beliefs about the tasks—that is, by later reporting (and indeed, believing) "the tasks really were kind of interesting."

Anthony-Masterson Photolibrary/Getty Images

Serious dissonance **The contradiction between this doctor's professional commitment to health and his smoking behaviour may produce noxious feelings of dissonance. To reduce these feelings, he may adopt a belief such as, "Smoking helps me relieve stress and too much stress is a serious health risk."**

Festinger's theory of cognitive dissonance has received support from hundreds of studies (Chaxel & Russo, 2015; McGregor, 2013; Wicklund & Brehm, 2013) that support Festinger's contention that dissonance creates both psychological and physiological discomfort. For example, Omid Fotuhi and colleagues from the University of Waterloo (2013) telephoned smokers from four countries (Canada, United States, United Kingdom, and Australia) over three successive time periods to ask them about their smoking-related beliefs as well as to inquire about quitting behaviour. The researchers report that smokers who were not trying to quit smoking in any of the time periods as well as those who had tried to quit but relapsed had the highest levels of rationalization for their smoking behaviours. Cognitive theory would support this finding; this theory predicts that we would ignore information that contradicts our beliefs. Kneer and colleagues (2012) argue that most smokers simply refuse to consider the health aspects of smoking (Jiraniramai et al., 2015). (See photo.) Shawn O'Connor and associates at the Ontario Tobacco Research Unit have shown that similar challenges exist in efforts to get teens to attend to the health issues involved in vaping, yet another dissonance issue (O'Connor et al., 2019).

Somewhat recent work involving fMRI assessments examined the participants in a cognitive dissonance paradigm under conditions where they had to assert a belief contrary

to another person's belief (Domínguez, Taing, & Molenberghs, 2016). Results implicated a network of brain areas (including increased activity in a number of areas of the frontal and parietal lobes). The main findings were that expertise plays little role in a cognitive dissonance task where participants had to disagree with statements made by others, both in terms of behaviour and brain activity. As well, participants who disagreed less frequently showed stronger activation responses when they did disagree.

The Self-Perception Alternative

Cognitive dissonance theory fits some instances of attitude change, but not others. In many cases, we seem to form and change attitudes in the absence of internal discomfort. You might think, for example, that you are alert, but after yawning, you might decide, "I'm tired"—not because of a need to reduce emotional tension brought about by the discrepancy between the attitude ("I'm alert") and the behaviour (a yawn), but simply because the yawn was informative. Psychologist Daryl Bem developed the **self-perception theory** of attitude change (Bem, 1972, 2017), arguing that at times we simply infer our attitudes from our behaviours. This theory minimizes the role of emotional discomfort and suggests that when we are *uncertain* of our attitudes, we simply infer what our attitudes are by observing our own behaviour, in much the same way as outsiders might observe us. According to Bem, our behaviours are often clues from which we deduce our attitudes—for example, we might decide we like roller coasters because we keep riding them, or you might decide you now like someone from high school (whom you used to despise) because you are now pleasant to her at university. He argued that the students in the Festinger and Carlsmith study (1959) who were paid $1 would not have experienced tension but would have instead looked at their behaviour and concluded that they would not have lied for a dollar, so they must have enjoyed the task.

> **self-perception theory** a theory suggesting that when people are uncertain of their attitudes, they infer what the attitudes are by observing their own behaviour.

Which is correct—the cognitive dissonance or the self-perception explanation of attitude change? Historically, this has been a source of great debate in social psychology; however, research has clarified that each may be right, but one may be more relevant in particular situations than the other (Howe & Krosnick, 2017; Albarracín, Johnson, & Zanna, 2014). Festinger's theory of cognitive dissonance seems more applicable to situations in which we behave in ways that are strikingly out of character for us, whereas Bem's self-perception theory may be at work in situations where we behave only slightly out of character or where our attitudes are not all that clear to begin with (Albarracin et al., 2014).

Hola Images/Getty Images

"Believe what I do, not what I say." Many people who endorse healthful eating and better fitness on surveys actually consume huge quantities of junk food in their daily meals.

Do Attitudes Influence Behaviour?

If we know someone's attitudes, does that mean we can predict that person's behaviour? It turns out that the attitudes people express are not necessarily related to how they actually behave (Kroesen, Handy, & Chorus, 2017; Phillips & Olson, 2014; McGregor, 2013). (See photo.)In the 1930s, a time when many Americans held very [unacceptable] negative attitudes toward Asians, sociologist Richard LaPiere conducted a field study in which he had a couple of Chinese descent travel across the United States and visit over 250 hotels and restaurants (LaPiere, 1934). Although managers at over 90 percent of the establishments indicated in a mailed questionnaire—received prior to the actual visit—that they would not serve "Chinese" guests, only one of the establishments visited by the couple actually refused them service. In fact, most of the hotels and restaurants provided above-average service, indicating that attitudes do not necessarily predict behaviour.

Of course, sometimes attitudes do predict behaviour. Attitudes toward work and one's workplace play a strong role in job satisfaction and as such are of interest to industrial organizational psychologists as well as to organizational managers (Fletcher, Alfes, & Robinson, 2018). See the Psychology@Work video on Work Attitude to see how this is done. Research has uncovered various factors that affect the extent to which attitudes will predict behaviours (Ajzen, Fishbein, Lohmann, & Albarracin, 2018; Baumgaertner, Tyson, & Krone, 2016; Rocklage & Fazio, 2014). One of the leading factors is *attitude specificity*. The more specific an attitude, the more likely it is to predict behaviour. If a woman specifically loves the music of Adele, for example, she is more likely to download Adele's new work the first day it is released than someone who loves soul or pop music more broadly. Another factor is *attitude strength*. Stronger attitudes predict behaviour more accurately than weak

or vague attitudes. For example, people who feel passionately about gay rights are more likely to join a demonstration than people who are in favour of gay rights but see this as a more general issue in light of fairness and legal rights for everyone (Lewis et al., 2017; Petty & Krosnick, 2014). Before the implementation of COVID-19 distancing requirements and the closure of schools in 2020, it was generally accepted in the Canadian population that "good" parents restricted the screen time of their children, which is recommended in such resources as the Canadian 24-hour Movement Guidelines (Tremblay et al., 2016, 2017) publications from regional health agencies (Fraser Health, 2018; Government of Alberta, 2020), which generally recommend no screen time for children under 2 years of age, up to 1 hour of screen time a day for those 2 to 4 years of age, and up to two hours for those aged 5 to 17. During COVID-19 restrictions, with children and parents being at home, and parents attempting to work from home, many parents were finding it impossible to maintain these guidelines (Bell, 2020) and were experiencing significant discomfort as a result. Subsequently, there came about a plethora of publications "modifying" screen time requirements slightly, expounding upon how it wasn't the amount of screen time, but the type of screen time, that was to be watched for, and, eventually, reassuring parents that allowing their children to stay in front of screens for large portions of the day was in no way problematic (Cheng & Wilkinson, 2020; Dell'amore, 2020). These later publications were slightly different in tenor than those that initially came out (Bischof, 2020). Think about how this sequence of events relates to what you have just learned about Cognitive Dissonance Theory, the Self-Perception alternative, and the holding, and alteration, of attitudes? Do you think screen time will be viewed differently by the public once the pandemic is over?

Video **PSYCHOLOGY@WORK**

Work Attitude **This video looks at the industrial/organizational psychology research into the role of attitudes in relation to job satisfaction and employee retention.**

Are People Honest About Their Attitudes?

One reason that attitudes fail to consistently predict behaviours is that people often *misrepresent* their attitudes. In fact, analyses of most self-report questionnaires—the tools usually used by researchers to measure attitudes—cannot distinguish genuine attitudes from false ones (Gaete, Gómez, & Benavides, 2018; Rasmussen, Grubbs, Pargament, & Exline, 2018; Eckman et al., 2014; Rosenberg, 1969). Why would people misrepresent their attitudes? There appear to be several reasons.

The Social Desirability Factor

Often, people state attitudes that are *socially desirable* rather than accurate. A person who privately does not trust people of a particular ethnic background, for example, may not acknowledge having this attitude for fear of being judged unfavourably by others (Krumpal, 2013). To eliminate the social desirability factor and measure people's genuine attitudes, some psychologists have employed the *bogus pipeline* technique (Jones & Sigall, 1971). Here, a research participant is connected to a physiological monitoring device such as a

polygraph (a lie-detector machine that measures physiological arousal) and is told that the device can detect deception. Participants believe the machine to be functioning and also believe that it can identify dishonesty. Therefore when individuals are connected to such a device, they are more likely to report their attitudes truthfully (Morawski & Donahue, 2017; Mitchell & Tetlock, 2015).

For example, investigators ask participants about socially sensitive issues, such as how frequently they drink, smoke, have sex, and use illicit drugs (Myers, 2016; Sonon et al., 2016; Tourangeau, 2014). Participants in one group were hooked up to a device and told that the device could detect inaccurate answers. The students hooked up to the machine reported performing socially sensitive behaviours relatively frequently. Control participants, who were not hooked up to the device, answered in more socially desirable ways, reporting lower frequencies of the behaviours in question. In another bogus pipeline study, Fisher and Brunell (2014) measured gender differences in cheating behaviour. Gender differences were diminished when participants believed that their responses were being monitored by a polygraph.

Implicit Attitudes

Another problem that researchers run into when trying to measure attitudes is that people are not always *aware* of their true attitudes (Berger, 2020; Dunham, Baron, & Banaji, 2016; Leavitt, Zhu, & Aquino, 2016). In their own minds, employers may believe that applicants of all ethnicities deserve a fair interview process. But when interviewing individuals from ethnic backgrounds other than their own, the same employers may, in fact, engage in less eye contact, maintain greater physical distance, and offer less interview time than when interviewing applicants whose backgrounds are similar to their own. In such cases, the employers may have difficulty trusting people of different backgrounds, but this attitude has not reached their conscious awareness (Foley & Williamson, 2019; Schlachter & Rolf, 2017). When attitudes such as these lie below the level of conscious awareness, they are called **implicit attitudes**.

implicit attitude an attitude of which the person is unaware.

The finding that people have implicit attitudes is reminiscent of the following observation by the famous Russian writer Fyodor Dostoyevsky:

> *Every man has reminiscences which he would not tell to everyone but only his friends. He has other matters in his mind which he would not reveal even to his friends, but only to himself, and that in secret. But there are other things which a man is afraid to tell even to himself, and every decent man has a number of such things stored away in his mind.*
>
> —White Nights and Other Stories (1918)

As you might imagine, measuring attitudes that the holder is not aware of presents a challenge for researchers. To get at implicit attitudes, researchers have employed one of several measures for assessing attitudes, the *Implicit Association Test (IAT)*. The IAT uses a person's reaction times to measure the strength of the implicit associations people have in their minds. The test consists of four stages.

First, a person is exposed to two broad categories—say, "dog" and "cat." The person is

asked to categorize certain words as belonging in the "dog" category or the "cat" category—for example, fire hydrant and litter box. If the word "fire hydrant" came up and the person saw this word as more dog-related, the person would click the left button. If the word "litter box" came up and the person saw this word as more cat-related, the person would click the right button. How quickly these decisions are made is measured by reaction time—that is, how long it took to decide which button to press—the right one or the left one.

Next, the person is asked to complete a different task in which they must categorize words as either pleasant or unpleasant. These words are again fairly obvious, such as "poison" and "happiness." Again, a right or left button press is used and reaction time is measured.

Next, the categories are combined in a third task, combining, for example, dog and pleasant and cat and unpleasant. The person is asked to identify a series of words as either more dog/pleasant or more cat/unpleasant. Again, a right or left button press is used and reaction time is measured.

The categories are then reversed to be cat/pleasant and dog/unpleasant. Again, a right or left button press is used and reaction time is measured. The assumption is that if a person implicitly believes that dogs are more desirable than cats, the person should be quicker to identify pleasant words during the dog/pleasant combination, because the association between pleasant things and dogs is stronger. It will take this person slightly longer to make the dog/unpleasant association because it requires more effort. Similarly, cat people should respond quicker to the cat/pleasant combination.

If you want to see how an Implicit Association Test works, go online to https://implicit.harvard.edu/implicit/takeatest.html and take one for yourself. You can be part of a research study with tens of thousands of participants.

You might find this logic convoluted and hard to accept. However, researchers have found that many Caucasian Americans who characterize themselves as not prejudiced have quicker reaction times to Caucasian American/pleasant and African American/unpleasant identifications than to Caucasian American/unpleasant and African American/pleasant ones. Such implicit attitudes appear to be stable over time, and they have been useful predictors of both subtle indicators of discomfort, such as turning one's eyes away during a conversation with someone of another race, and overt acts of racism, such as the use of slurs, physical violence, and snubbing (Baston & Vosgerau, 2016). Researchers have also used the IAT to detect bias against gender, elderly people, overweight people, women, the disabled, and other groups (Gould et al., 2019; Babcock et al., 2016; Dunham et al., 2016; Williams & Steele, 2016; Hinman et al., 2015).

Bertram Gawronski and his colleagues at the University of Western Ontario have investigated different approaches to reducing both implicit and explicit components of prejudiced beliefs. They have found that diversity training and guided exposure to the groups toward which prejudiced beliefs are directed work to reduce explicit prejudiced beliefs, while fear reduction and other emotion-focused interventions work best to reduce implicit aspects of prejudice (Gawronski, 2019; Gawronski & Brannon, 2019; Gawronski & Bodenhausen, 2014).

Gawronski's key finding is that simple, one-element efforts to reduce prejudice do not work. Instead, he argues that a multiple component effort would be more effective if it focused on several of the following options: listening to persuasive messages arguing against prejudiced views toward a particular group; having people write arguments supporting an unprejudiced perspective; and trying to reduce the affective reaction associated with a particular group by presenting information about them in neutral or non-affect associated situations. Gawronski's research has demonstrated that combinations of these sorts of approaches result in more positive changes in participants' prejudicial cognitions and emotions (Gawronski, 2020, 2012; Hahn & Gawronski, 2019; Gawronski & De Houwer, 2014). The discriminatory treatment of Indigenous persons within Canadian society (Currie et al., 2012; Ly & Crowshoe, 2015; Pendakur & Pendakur, 2011) suggests prevalent negative attitudes toward this group. Given what you have just learned about implicit and explicit attitudes and strategies to change these, what thoughts do you have about the sorts of things various institutions or levels of government might do to try and address these issues? Think back to high school. Did you take an Indigenous studies class? Did your school promote cultural days, or Indigenous awareness days? Were you required to write any essays or commentary supportive of Indigenous experiences? The Canadian federal government has developed and anti-racism strategy (Canadian Heritage, 2019) that seeks to engage with provinces and territories and communities and to raise public awareness and shift attitudes. At this point there is still some distance to go. Consider Pendakur and Pendakur's (2011) findings that increased size of the Indigenous population in Canada did not result in a lessening of the wage differentials between Indigenous and non-Indigenous people. Given Gawronski's finding that single one-element efforts do not produce significant change, it seems clear that a broader range of initiatives are needed if there are to be significant reductions in negative attitudes towards Canada's Indigenous peoples.

Stereotypes and Prejudice

Although Hurricane Katrina, which hit Louisiana in 2005, occurred when many of you were very young, it remains a very important and controversial time in American history. Hurricane Katrina was one of the deadliest hurricanes in the history of the United States. Almost 2000 people died—many of them poor and many of them African American. In the wake of Hurricane Katrina, millions of people began reaching out with contributions and charity to help the people suffering. During a special charity drive, which aired on most major television networks, rap star Kanye West made the following statement about the disaster:

> *I hate the way they portray us in the media. You see a black family, it [the media] says, "they're looting." You see a white family, it says, "they're looking for food." And, you know, it's been five days [waiting for federal help] because most of the people are black. . . .*

In part, West was talking about *stereotypes*. Most of us are familiar with the notion of **stereotypes**—generalized impressions about people or groups of people based on the social category they occupy. Stereotypes can be based on age, race, and region of origin, as well as political or religious beliefs, or any other group characteristics.

stereotypes fixed overgeneralized and oversimplified beliefs about a person or a

group of people based on assumptions about the group.

Although stereotypes may be positive or negative, there is little doubt that there is a strong relationship between stereotypes and **prejudice**—negative feelings toward individuals from another group. Both stereotypes and prejudice lead to discrimination, which is a negative behaviour or action aimed at an individual or a specific group of individuals (see photos). Americans are not the only residents of this continent to exhibit prejudice as a result of stereotyping. First Nations peoples were exposed to bias during the Alberta floods of 2013. When Indigenous people responded with a lack of enthusiasm to the restrictions placed upon their "aid," they were criticized for being ungrateful, whereas when non-First Nations communities displayed a similar lack of enthusiasm, it was the government, not the communities, that was presented in the media as behaving inappropriately, by providing inadequate support to deserving communities in need (Thurston & Schill, 2015). For another perspective on these issues consider Indigenous Experiences 13.1.

prejudice negative and unjust feelings about individuals based on their inclusion in a particular group.

In spite of Canada's claims that we have achieved acceptance of multiculturalism and diversity (Porter, 2015; Poolokasingham, Spanierman, Kleiman, & Houshmand, 2014; Blake, 2013), Indigenous peoples are not the only peoples to experience insinuative biases. In addition to the long history of prejudice, negative attitudes, and discrimination toward our First Nations populations (Lashta, Berdahl, & Walker, 2016; Nesdole, Lepnurm, Noonan, & Voigts, 2015; Clark et al., 2014), we also demonstrate bias against those of other races and ethnicities (Blake, 2013; Poolokasingham et al., 2014; Porter, 2015; Zellars, 2016), and of different religions. Anti-semitism, for example, is a problem not only globally but also within Canada, (Hollinger, 2020; Robinson, 2015) and a study by Zafar and Ross (2015) found attitudes in Canada toward those of the Muslim faith to be particularly negative. Attempts to manage discrimination through legislation have been imposed with debatable effects (Hollinger, 2020).

AP Images/Dave Martin

Chris Graythen/Getty Images

Racial bias **In the aftermath of Hurricane Katrina, newspapers carried many photos of desperate and hungry people taking food from local food stores. The news caption that accompanied the photo on the left (of an African American) stated that the man had just finished "looting a grocery store," whereas the one that accompanied the photo on the right (Caucasian Americans) said that the two individuals had just finished "finding bread and soda at a local grocery store."**

13.1 Indigenous Experiences

Stereotyping and the "Sixties Scoop"

Following World War II, the Canadian government took over the administration of residential schools. To that point, many schools had been providing only rudimentary educations at best. After that, instead of schools, they began to largely function as institutions for Indigenous children that the government deemed to be receiving inadequate care at home (Truth and Reconciliation Commission of Canada, 2015). Around this same time, government social service agencies lobbied for changes to the Indian Act and, in 1951, amendments were made that enabled provincial departments of health, welfare, and education to have jurisdiction on reserves (McKenzie, Varcoe, Browne, & Day, 2016). Provincial governments differed in the agreements they signed with the federal government outlining how on-reserve welfare programs would operate and be funded, but none supported preventive services that would help families remain together (Sinha & Kozlowski, 2013).

It is important to note that many scholars recognize that "good intentions" lay behind these changes, but one scholar adds that "little attention was paid to the effect that extending provincial services would have on Indian families and communities"

(Johnson, 1983, p. 3). However, stereotypic thinking of what was in the best interests of children played a significant role in the events that followed. "Indigenous children often were apprehended because of incongruences between Euro-Western [stereotyped] notions and cultural practices [about "good" parenting] and the realities of Indigenous communities…. [and] did not consider the long-term effects of child apprehension on children, their families, and their communities" (McKenzie, et al., 2016, pp. 6–7).

In what was later labelled "the Sixties Scoop," beginning in the 1950s and 1960s, and extending into the 1980s, the government of Canada implemented a wholesale foster and adopt program for Indigenous children (Fachinger, 2019). Many Indigenous children were forcibly removed from their homes of origin and placed in foster or adoptive homes with non-Indigenous families. These "protection" practices intensified the hurt perpetrated by the residential school system. Countless children experienced abuse and neglect in the homes in which they were placed (Truth and Reconciliation Commission of Canada, 2015). Even those children placed in nurturing and loving homes were affected by discrimination and racism and suffered from being placed in permanent care away from their own families and communities. The consequences of such actions were far reaching and affected every aspect of the lives of the children, the families who lost their children (often without their knowledge or consent), and subsequent generations (McKenzie et al., 2016).

THE CANADIAN PRESS/Jason Franson

Sixties Scoop Survivors of the "sixties scoop" and their families prepare to hear then Alberta Premier, Rachel Notley's apology at the Alberta Legislature, in Edmonton, Alberta.

The late author and journalist, television broadcaster/producer and documentary producer, Richard Wagamese, an Anishinaabe (Ojibwe) from the Wabaseemoong Independent Nations in Ontario, and a survivor of foster care, wrote an essay entitled "Surviving the Scoop." In it, he said, "[T]his sad chapter [the Sixties Scoop] in our country's history followed closely on the heels of the closure of the residential schools. To those affected, the Scoop felt like a continuation of the same genocidal policy. For me, it meant the door was effectively slammed shut on my identity" (as cited by

Fachinger, 2019, p. 118).

Critical Thinking Questions

In what ways did stereotypic thinking interact with the "good intentions" behind the huge jump in the numbers of Indigenous children in foster care during the "Sixties Scoop?"

How might the cultural experiences of Indigenous children be impacted by their being fostered or adopted by non-Indigenous families?

In what ways were the Sixties Scoop and residential school experience similar?

Some psychologists believe that the human tendency to identify with a group is one of the main contributors to stereotypes and prejudice (Sherif, 1967; Dovidio, Schellhaas, & Pearson, 2019). Evolutionary psychologists believe that as humans, we generally categorize ourselves in terms of our similarities to some people and our differences from others. Sometimes referred to as the *mere categorization effect* (Zajonc, 1968), it has come to be accepted that the mere act of categorizing individuals into groups causes them to identify themselves as "us" or "them." Understanding ourselves as members of a particular group (our *in-group*) offers us some insight into who we are. Similarly, perceiving people outside our group as members of other groups (*out-groups*) gives us information—not necessarily valid information—about who they are. This basic categorization structures our future perceptions. Denis Krebs at Simon Fraser University argues that we then use this basic categorization to identify with those we favour and with those we choose to discriminate against (Krebs & Denton, 2014). Since we view those in the out-group as different than ourselves or our in-group, Krebs argues that we therefore feel very little empathy for those in the out-group and thus feel justified in discriminating against them.

© 1988 Muzaref Sherif and reprinted by permission of Wesleyan University Press.

The Robbers Cave experiment The Robbers Cave experiment is a classic study of group formation.

Source: From "The Robbers Cave Experiment" by M. Sherif, O. J. Harvey, B. J. White, W. R. Hood, and C. W. Sherif, Wesleyan University Press, 1988, p. 103.

Evolutionary psychologists suggest that stereotypes and prejudice may have had some adaptive value, as our ancestors probably prized being able to quickly recognize members of their own tribe based on superficial information (Simpson & Kenrick, 2013). Early humans needed to quickly identify other figures as friends or foes, and general appearance would have been an easy way to accomplish this goal. Evolutionary psychologists also suggest that we may be prewired to think of people whom we perceive to be different from us as inferior, which may cause or justify our decisions to exclude or demean them (Kteily et al., 2015; Durante et al., 2013).

A view called the *realistic conflict theory* argues that competition arises between different groups because of conflict over scarce resources (Jackson, 1993; McKenzie & Twose, 2015). A classic study, Sherif's Robbers Cave Experiment, illustrates this theory (see photo). Remember that according to this theory, the amount of actual conflict between particular in-groups and out-groups determines the degree of prejudice or discrimination between those groups. A group of 22 11-year-old boys were taken to a camp in Robbers Cave State Park in Oklahoma. The boys were randomly divided into groups before leaving for camp. The groups were housed separately and did not know of the existence of the other group. Each group chose a name ("Rattlers" and "Eagles") and they put the name on their shirts and flags. After a week the two groups met and engaged in a series of competitions against one another. The Rattlers were the winners. The two groups began to call one another names, refused to eat in the same room, and engaged in a series of negative behaviours

toward one another. Having deliberately sowed the seeds of discontent, the experimenters then worked to see if the boys in the two groups could overcome their animosity. A series of problems arose that required that all of the boys work together to overcome them (contaminated drinking supply, etc.). The boys began to eat together once more and when the time came to leave, they voted to take the same bus home (Sherif, 1961). This study gave people hope that peace could flourish between former enemies if they were able to exceed the boundaries of their individual groups. Indeed, data suggest that forming emotional ties to those we stereotype can actually create a positive change in attitude, creating warmer, more emotional links to individuals previously stereotyped (Sevillano & Fiske, 2016).

Another view, **social identity theory**, suggests that in social situations individuals often identify as a member of the group (Tajfel, 2010; Trepte & Loy, 2017). They see themselves at times as a group member rather than as an individual (Langner & Wiedmann, 2015). Social identity theory proposes that prejudice emerges through three processes:

Social categorization, in which a person affiliates with a particular group as a way of figuring out how to act and react in the world.

Social identity, in which the person forms an identity within the group.

Social comparison, in which the group member compares the group favourably with other groups, and in turn derives a sense of positive well-being from looking at himself as superior in some way.

social identity theory a theory that emphasizes social cognitive factors in the onset of prejudice.

In one of his early studies, Tajfel (1981) randomly assigned study participants to two groups and then had them decide how to divide a sum of money between two people identified only by their group membership and an ID number. Participants typically showed what Tajfel called an in-group bias by giving more of the money to the person in their group than the person in the other group. Even with no group interaction, the effects of social categorization, social identity, and social comparison can be seen in this result. Now think back to the in- and out-group environment that was probably evident in your high school, and see if you can identify examples of social behaviour that reflect the three central factors of social identity theory just discussed.

Attitudes and the Power of Persuasion

Earlier, we discussed how attitudes form and change. Advertisers have taken a strong interest in these processes. In fact, billions of advertising dollars are devoted each year to helping people develop particular attitudes toward products or services. If you wouldn't dream of using any computer but a MacBook Pro® (or Air®), or if you much prefer Coke® over Pepsi® (or vice versa), that attitude probably has been created in part through persuasion—the advertiser's best efforts to convince you that its product is far superior to anyone else's and that you must have it. Politicians running for office, interest groups looking to increase their influence, and any number of others also regularly use persuasive techniques. Indeed, most of us have had occasion to try to persuade someone else to come

around to our way of thinking.

For persuasion to occur, a few elements must be present (Petty & Cacioppo, 1986). There must be, of course, a *message*, somebody to transmit the message (the *source*), and somebody to receive it (the *receiver*). In attempting to make a message persuasive, the source can use methods that follow either a central route or a peripheral route (**Figure 13.3**). While Petty and Cacioppo's original research examined responses to televised speeches about nuclear armaments by American President Ronald Reagan and Soviet Premier Mikhail Gorbachev, the same key elements can be found in guides offered more recently for how to become a social media influencer (Lou & Yuan, 2019).

Central Route versus Peripheral Route

The *central route* to persuasion emphasizes the content of the message, using factual information and logical arguments to persuade. This method requires a fair amount of effort on the receiver's part and is more commonly used for matters of some significance (Petty & Cacioppo, 1986). If you were trying to decide whether to buy a Mac or a PC, you might be willing to spend considerable time in careful deliberation of all the facts. After all, a computer is an expensive item and an important purchase. You might not be as interested in thinking hard about whether to buy Coke® or Pepsi®, however, or about which brand of shampoo to purchase.

The *peripheral route* relies on more superficial information. When you respond to peripheral appeals, you are responding to such factors as how attractive the spokesperson is and how amusing or engaging the message is (Petty & Cacioppo, 1986). As might be expected, decisions based on central routes to persuasion are more likely to last than decisions based on the peripheral route.

Aids to Persuasion

Beyond the route chosen, a number of other factors can also make a message more or less persuasive. Characteristics of the *source* are important (Petty & Cacioppo, 1986). We are more likely to be persuaded by a source who is rated as more knowledgeable or more likeable, for example. In addition, if we think of the source as more similar to us, we are more likely to be persuaded by the message. (This is part of the reason why wealthy political candidates often try to emphasize their middle-class roots by speaking in shopping malls and grocery stores.) Finally, at least in some instances, people are more likely to find a source credible and persuasive when the source presents both sides of an issue (Clark & Evans, 2014).

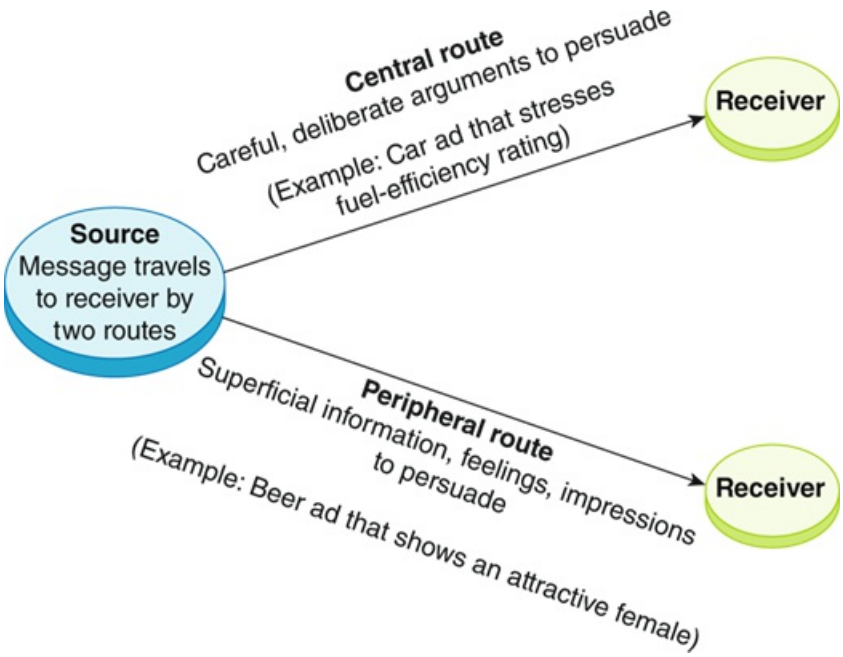


FIGURE 13.3 Two routes to persuasion

Sometimes the key to persuasion rests on an interaction between audience characteristics and source characteristics. If, for example, a source is trying to win the favour of an intelligent or highly motivated audience, an emphasis on logic and on supporting data is more likely to carry the day (see photos). If addressing a less intelligent or less interested audience, however, the source might have more success with a glossy, superficial presentation and a good haircut.

Rachel Megawhat/Alamy Stock Photo

Tetra Images/Getty Images

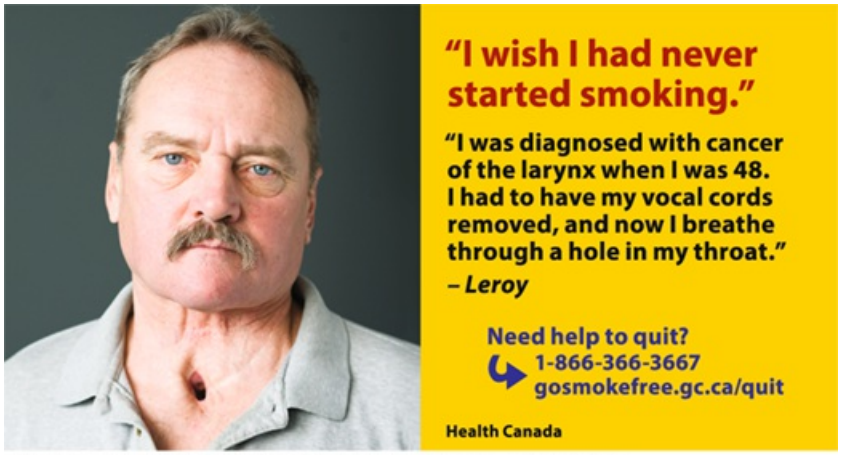
Tools of persuasion The organization People for the Ethical Treatment of Animals (PETA) has run many campaigns to persuade consumers to stop eating meat and become vegan. Which of these approaches is more likely to help change the minds of meat eaters—the image of protesters lying naked smeared in a blood-like substance (left), or the spokesperson who systematically presents facts and figures on the merits of a vegetarian lifestyle (right)?

A number of *specific techniques* can further improve the chances of successfully persuading others (Dolinski, 2015). We will mention three here. You have probably been exposed to all of these strategies (and you may have even used them).

The *foot-in-the-door technique* involves getting someone to agree to a small request and then following up with a much larger one (Mitchell & Tetlock, 2015). The idea is that a bond has been forged between the requestor and the requestee, so the requestee will be inclined to grant the second request because of having granted the first one. For example, you might first ask to borrow your friend's truck to move some furniture for an afternoon, and then later ask to borrow it for the entire weekend as the move is taking longer than you had anticipated. Having already granted the smaller request your friend is more likely to agree to the much larger request. Why? Recall our earlier discussion about cognitive dissonance. We strive to be consistent. Your friend made a decision to help you with your move and so now does not want to go against that earlier decision by turning down your larger request. Scammers use this technique to bilk money from gullible lonely singles or seniors, starting with small requests and then escalating (Whitty, 2013).

The *door-in-the-face technique* reverses this behaviour. The technique involves making an absurd first request that will obviously be turned down, and then following it with a more moderate request (Henderson & Burgoon, 2014). Here the idea is that if the first request is turned down, the requestee feels guilty and so is more likely to comply with a second, more reasonable, request in order to reduce the guilt. For example, a teenager might wake a parent who is napping to ask her parent to drive her to a friend's place across town. When the parent replies that they are obviously resting, the teen follows with a request for money for a cab. The door-in-the-face technique works because a person (the parent in this case) feels guilty for turning down the first request and may fear rejection based on their decision. Thus, complying with the second request allows a person to alleviate their guilt and relieve concerns about social rejection.

Appeals to fear can be powerful. We frequently see these appeals in anti-smoking campaigns (Cummings, 2020; Nabi & Myrick, 2019; Halkjelsvik, 2014) (see photo) and in political campaigns (Rold & Honeycutt, 2016). In order to work, however, an appeal to fear must have a credible source sending the message, and must make receivers truly believe that something bad will happen to them if they don't comply with the source's request. Most importantly, the appeal must provide the receiver with an explicit recommendation for change. For example, there is no sense in worrying about an asteroid hitting earth because there is nothing you can do about it. But if you use condoms when having sex you significantly reduce your chances of contracting HIV or other STDs. So advertisements urging you to use condoms are likely to be more effective than advertisements urging you to purchase protection from asteroids.



© Her Majesty the Queen in Right of Canada, represented by the Minister of Health (2014).

Fear as persuasion **Anti-smoking ads commonly use fear—the fear of life-threatening illness or disgusting physical outcomes—to try to persuade smokers to quit.**

Barriers to Persuasion

Other strategies can interfere with persuasion. We will mention only a couple.

Forewarning an audience that you will be trying to persuade them of something will immediately raise their defences. Although listeners in this situation may make subtle shifts toward your way of thinking, they are unlikely to change their attitudes as much as individuals who are not told that they are about to hear a persuasive speech (Weitzl, Seiffert-Brockmann, & Einwiller, 2020).

Beginning with a weak argument instead of a strong one can make subsequent arguments seem weaker (Stiff & Mongeau, 2016). For example, a child arguing for an advance on their allowance and arguing by saying she wants the money to buy some candy might lead the parent to interpret a subsequent argument—that the child gave money to a friend at school who had no lunch—as more of an excuse than a valid argument.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

1. What are the three components of attitudes, according to the ABC model?

2. How do cognitive dissonance theory and self-perception theory differ in their explanation of attitude change?

3. Overall, are Canadians holding negative implicit or explicit attitudes toward Indigenous Canadians and if so how should the government direct efforts to manage attitudes toward Indigenous peoples in Canada?

4. Why do people sometimes misrepresent their attitudes?

5. How does social identity theory explain prejudice?

6. What are the central and peripheral routes to persuasion?

What Do You Think? • Watch a television advertisement or select a print ad and critique it according to the material in this section. For example, does the advertisement use the central or the peripheral route? Was that a good route for the advertiser to choose, considering the product being advertised?

Social Cognition: Attributions

LEARNING OBJECTIVE 2

Discuss how people make attributions to explain their own behaviour and the behaviour of others.

In many ways, we are all lay psychologists, continually trying to explain what we see in our social worlds so that we can make sense of events and predict what will happen in the future. We attempt to figure out *why* people, including ourselves, do things. Social psychologists refer to these causal explanations as **attributions**, and they are interested in what influences our attributions and how such attributions affect our subsequent decisions, feelings, and behaviours (van Noorden et al., 2016; Smith, Mackie, & Claypool, 2014).

attributions causal explanations of behaviour.

Dispositional and Situational Attributions

Attributions fall into one of two categories. *Dispositional*, or *internal*, attributions focus on people's traits as the cause of their behaviour (Försterling, 2013). In contrast, *situational*, or *external*, attributions focus on environmental factors as the cause of behaviour (Sultan & Hagger, 2014; Försterling, 2013).

Social psychologist Lee Ross (2018, 2001, 1977) has referred to our reliance on dispositional attributions to explain the behaviour of other people as the **fundamental attribution error**. When we are almost hit by a speeding driver, we are likely to conclude that the driver is reckless and irresponsible, even though, in fact, she might have been racing to the hospital to see a stricken child. When we meet a woman who is not very talkative, we may conclude that she is withdrawn and arrogant, when in fact she might be a normally friendly sort who has a terrible cold. When a professor provides unsatisfactory lectures, we may assume that he is disorganized or incompetent, when in fact he may be a single father struggling with an autistic child or may be constrained by the policies of the university (Moran, Jolly, & Mitchell, 2014).

fundamental attribution error the tendency to use dispositional attributions to explain the behaviour of other people.

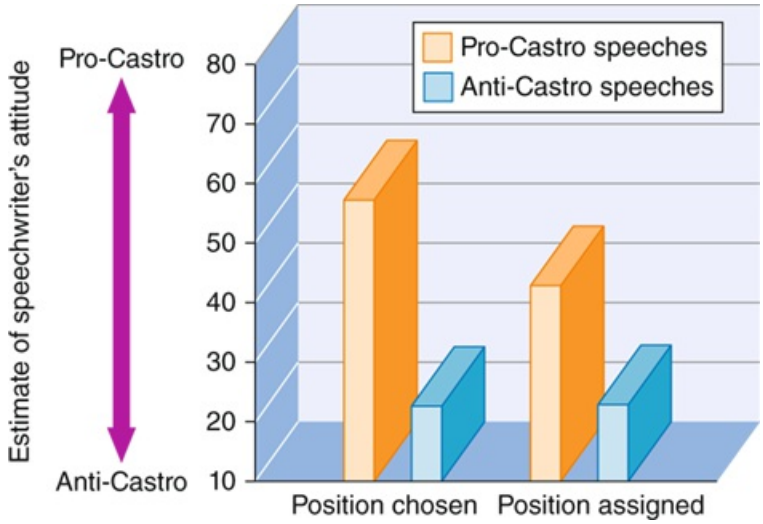


FIGURE 13.4 The fundamental attribution error Even when told that pro-Castro or anti-Castro speechwriters had been randomly assigned their positions, research participants assumed that the speechwriters truly believed what they had written (Jones & Harris, 1967).

Source: Adapted from Myers, D. G. (2002). Social psychology (7th ed.). New York: McGraw-Hill, Figure 3-2; data from Jones, E. E., & Harris, V. A. (1967). The attribution of attitudes. Journal of Experimental Social Psychology, 3, 1–24.

What determines whether we make dispositional or situational attributions? Research suggests that when explaining *other* people's behaviour, we tend to rely more heavily on dispositional attributions. In a classic study from the 1960s, researchers had participants read a speech that expressed either support for or opposition to Cuban leader Fidel Castro. They then asked each participant to rate the extent to which the speechwriter was pro-Castro (Jones & Harris, 1967). Participants who read a speech supportive of Castro naturally rated the speechwriter as pro-Castro, and those who read a speech critical of Castro naturally rated the speechwriter as anti-Castro. These were dispositional attributions; the participants reasoned that the speeches reflected internal characteristics of the speechwriters. But then the participants were told that the speechwriters had been randomly assigned to write either a pro- or anti-Castro speech. In other words, the participants were given a reason to make a situational attribution rather than a dispositional one. Remarkably, even with this knowledge, the participants rated speechwriters who had written supportive speeches as very pro-Castro and speechwriters who had written critical speeches as very anti-Castro (see **Figure 13.4**), indicating that we do not use situational information even when it is available.

However, we can learn not to make the fundamental attribution error—or at least to make it less often. Research indicates that automatic stereotyping and prejudice are reduced when participants are exposed to the Situational Attributional Training Technique. The essence of this training is to get people to consider the external causes for someone's

behaviour rather than to immediately jump to making an unfavourable dispositional attribution (Rachmawati, Purwanto, & Awalya, 2018; Hooper et al., 2015). We make the fundamental attribution error because information about the situations of other people is often difficult to get and even more difficult to use and so we fall back on an easier dispositional attribution. However, the work by Hooper and colleagues suggests that we can learn to use situational information if we make the effort to take the perspective of another person.

The Actor–Observer Effect

Social psychologists refer to the discrepancy between how we explain other people's behaviour and how we explain our own behaviour as the **actor–observer effect** (Jones & Nisbett, 1971). The idea of the actor–observer effect is that as *actors*, we tend to make situational attributions about our behaviours; and as *observers*, we tend to make dispositional attributions about the behaviour of others (**Figure 13.5**). For example, as an actor, if we skid into a ditch and get stuck in the deep snow we will most likely make a situational attribution, "The roads are so icy, I never had a chance." However, if we witness the identical situation with another person we make an internal attribution, such as, "She was probably driving way too fast." In this instance, as the observer, we view the other person as having been careless—an internal attribution. Several explanations have been offered as to why this is so (Forgas & Williams, 2014). For one thing, as actors, we have information about ourselves that observers don't have. We know from experience, for example, that we don't act the same way in every situation; we know, for example, that we typically drive carefully and do not regularly skid off the road. For another thing, observers tend to focus on the actor, while actors need to focus more on situations. Consider your response as you watch a fellow student give a very bad presentation. You (as the observer) have no information beyond what you can see. What you see is a disorganized, rambling talk that conveys very little understanding. However, the fellow student (the actor) knows that her situation is beyond her control. She was exceptionally prepared but upon arriving at school saw her partner embracing another person and was therefore too distressed to give the presentation coherently. Interestingly, if people are shown videotapes of their own behaviour—that is, if they become observers—they tend to make more dispositional attributions (i.e., make the fundamental attribution error) about the causes of their behaviour (Storms, 1973). That is, the video enables them to switch from actors to observers, and their explanations for their behaviours switch correspondingly.

> **actor–observer effect** the discrepancy between how we explain other people's behaviour (dispositionally) and how we explain our own behaviour (situationally).

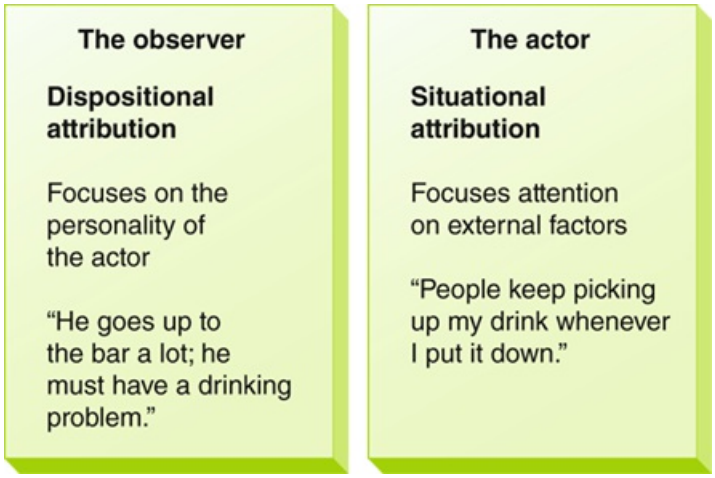


FIGURE 13.5 The actor–observer effect We tend to explain our own behaviour in terms of external factors (situational attributions), and others' behaviour in terms of their internal characteristics (dispositional attributions).

The actor–observer effect is a problem because it is an attributional bias that affects how we perceive and interact with others. When we make dispositional attributions about other individuals we engage in stereotyping, and stereotyping often leads to misjudging others. Note that we are most likely to make dispositional attributions about others when outcomes are negative. What sort of attributions do we make when the "person" we are interacting with is not human? That may sound like a stupid question but about when we are interacting with an artificial intelligence managed robot like Sophia. To find out about Sophia have a look at Your Brain and Behaviour 13.1.

13.1 Your Brain and Behaviour

Facilitating Robot–Human Interactions and Avoiding the "Uncanny Valley"

Robots are here and will likely become even more commonplace in our everyday existence over the next two decades. Robots currently vacuum our floors, answer our doorbells, and even drive our cars. Of course, when we think of robots we don't often think of Roombas, Alexa, or a Tesla. Rather, we think of machines that look more like us. On October 25, 2017, Sophia (see photo on next page), one of many human-like robots that have been made by Hanson Robotics, was given Saudi citizenship in Riyadh, Saudi Arabia. Looking at the photo of Sophia, it is obvious that her features are eerily similar to our own. With hair, she may even be able to pass us on a busy city street without any of us noticing that she is not human.

Researchers in neuroscience and robotics are keenly interested in how our brains respond to how robots look (Henschel, Hortensius, & Cross, 2020; Rosenthal-von der Pütten et al., 2019; Rosenthal-von der Pütten & Krämer, 2014). One aspect of robot development, and our liking of them, that is often discussed in robotic circles is how to avoid the "uncanny valley." This concept was first described by Masahiro Mori (1970) but was long ignored by robotic developers and social scientists. This concept is that as

a robot begins to look more and more like us, we may no longer like it but rather find it eerie and creepy. In some cases, we may even feel repulsion. Some of you may feel this way when you look at Sophia: the lifelessness of the eyes seems to be especially important in decisions about robot likeability.

Neilson Barnard/Getty Images

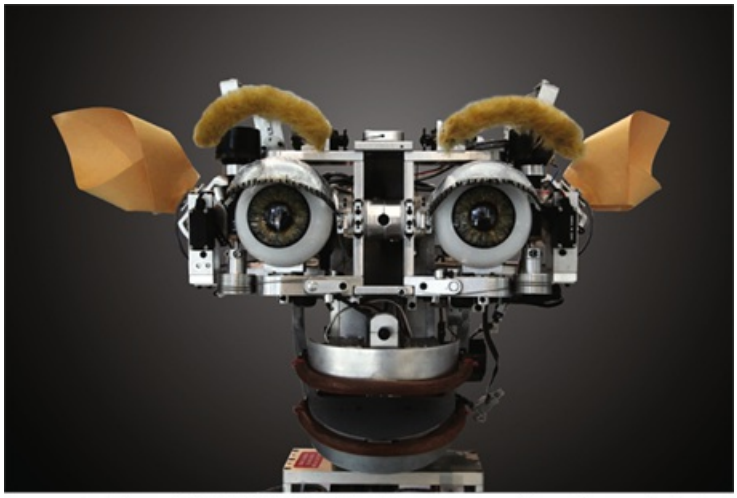
To try to figure out how to avoid the uncanny valley in robotic development, neuroscientists have begun to study how our brain responds to different robotic styles. What scientists have found is that people like robots better that look like us, but when robots become too lifelike we report liking them less, and this is reflected in our brain activity. When we look at robots that are lifelike, we see changes in the activation of the brain in areas such as the ventromedial prefrontal cortex and the amygdala. When we look at robots we like, we see higher activation in each of these areas, but when we look at robots that appear to be too human, activity in both of these areas drops off and we dislike them. The uncanny valley that was proposed in 1970 seems to have its roots in the activity of our very human brain.

Questions

Which regions of the brain are most active when making decisions about whether we like a person or a robot?

What areas of the brain are activated differentially when we look at a robot and think about it experiencing pain or pleasure?

What features of a human-like robot are most likely to influence how we respond to them? What do you think humanoid robots should look like?



Source: By Rama, CC BY-SA 3.0 fr, https://commons.wikimedia.org/w/index.php?curid=89032593

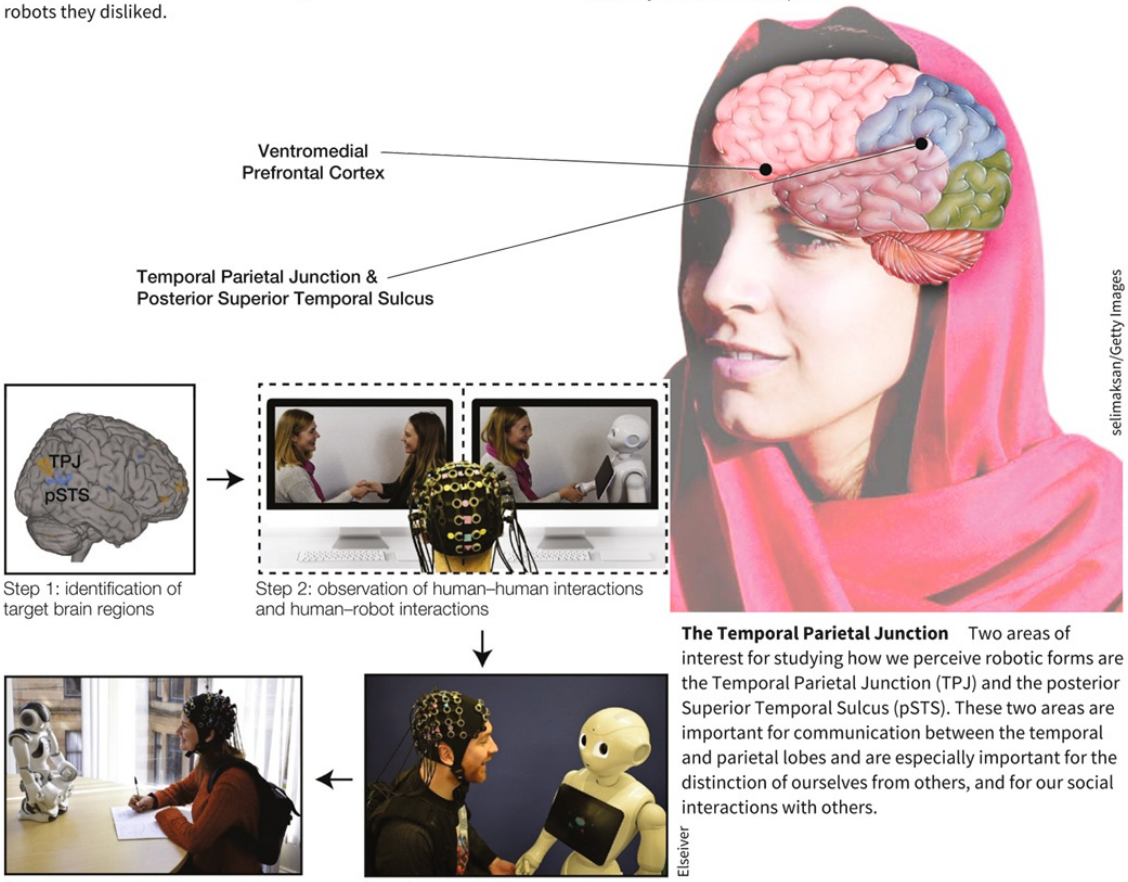
KISMET - The first robot to recognize emotion KISMET is a robot head made in the late 1990s at the Massachusetts Institute of Technology by Dr. Cynthia Breazeal (shown on the left). KISMET was one of the first robots to recognize emotions and socially interact with humans.

Rosenthal-von der Putten et al., *Journal of Neuroscience* 14 August 2019, 39 (33) 6555-6570

What do we prefer? This image taken from Rosenthal-von der Pütten (2019) shows different robotic forms. Participants were asked to rate how much they liked each of these robots. While the participants in this study reported liking the robots that appeared more human like (the middle image) they disliked the robot that appeared too human. One of the key areas in the brain for this change from like to dislike appears to be the ventromedial portion of the prefrontal cortex. Activity in this area dropped off significantly when participants viewed images of the human-like robots they disliked.

DENIS BALIBOUSE / REUTERS

Sophia - A human-like robot made by Hanson Robotics How we respond to robots or avatars in our real lives, or in virtual reality spaces, influences how we may interact with online robot counsellors, teachers and health care practitioners of the future. The study of robot-human interactions is in its infancy but data has shown that our brains like robots that are human like, but not too human. How do you feel about Sophia?



The Temporal Parietal Junction Two areas of interest for studying how we perceive robotic forms are the Temporal Parietal Junction (TPJ) and the posterior Superior Temporal Sulcus (pSTS). These two areas are important for communication between the temporal and parietal lobes and are especially important for the distinction of ourselves from others, and for our social interactions with others.

Brain activation When we study human-human or human-robot interactions we are looking for differences in the activation of the brain, using various neuroscience techniques during these interactions.

Exceptions to the Fundamental Attribution Error

Despite the trend just described, we do not *always* attribute other people's behaviours to their internal characteristics or personalities. When we know that just about everyone would react the same way in a given situation, we will likely conclude that a person's behaviour in that situation is situationally caused (Korman & Malle, 2016). When most persons are robbed at gunpoint, for example, they (wisely) hand over their money. Thus, a particular robbery victim's surrender of money will usually be attributed to powerful situational factors.

Similarly, if we are given detailed information about situational pressures, we may attribute the behaviour of other people to situational factors. Think back, once again, to the events surrounding Hurricane Katrina. Initially, most television viewers assumed that all New Orleans residents who had stayed at home rather than evacuate to another city were stubborn, or foolish, or both. However, when information later revealed that thousands of the city's residents were too poor to own a car and that all public transportation systems had shut down, most viewers shifted to a situational explanation for the residents' behaviour.

By the same token, we do not *always* attribute our own behaviour to situational factors. Let's say, for example, that you do poorly on an examination and complain that the questions were "too hard" and the grading unfair. You are, as we would expect, making a situational attribution for your poor performance. But suppose you get a good mark on the next examination. Will you explain your success by pointing out how easy the exam questions were or how generous the grading was? Not likely.

Consistent with this point, social psychologists have noted that when we explain our own behaviour, we are able, and often likely, to fluctuate between situational and dispositional attributions, depending on which puts us in a better light. In other words, we tend to attribute our successes to internal causes and our failures to external ones—a phenomenon referred to as the **self-serving bias** (Wieman & Welsh, 2016; Miller & Ross, 1975). Research also has indicated that the direction of our attributions can be influenced by factors such as our moods and emotions, motives, prejudices and stereotypes, and cultural background (Major & Dover, 2016; Newey, 2016; Rubenstein et al., 2016; Wilson & Buttrick, 2016; Tasimi & Johnson, 2015; Schwarzer, 2014; Smith, Mackie, & Claypool, 2014).

> **self-serving bias** the tendency people have to attribute their successes to internal causes and their failures to external ones.

Indeed, in some cases it would appear that the self-serving bias serves a protective function for self-esteem; for example, researchers have found that depressed individuals sometimes have a more realistic perception of themselves and their abilities, a phenomenon known as depressive realism, or the sadder-but-wiser hypothesis (Moore et al., 2016).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

7. How do dispositional and situational attributions differ?

8. What is the fundamental attribution error?

9. What are some exceptions to the actor–observer effect?

What Do You Think? • How do you think empathy might influence the actor–observer effect?

Social Forces

LEARNING OBJECTIVE 3

Describe the power of conformity and obedience in shaping people's behaviour.

As bad as conditions were in the last-resort shelters after Hurricane Katrina, they were even worse in the New Orleans Convention Center. A small group of people decided to make their way to this facility, even though it had not been designated a shelter. Others followed, until the convention centre was filled with thousands of displaced souls. Those people waited for days for food and support to come. However, because the convention centre had never been formally designated a shelter, federal and state agencies did not even know anyone was there. Not until days later, when television and news reporters "found" those in the centre, were they included in the city's relief efforts.

Given the chaos and uncertainty in the aftermath of Hurricane Katrina, it is understandable that people would look for any sign of what to do or how to get help. The fact that a small group of people decisively sought shelter at the convention centre, even in the absence of any information about whether that was a good choice or not, was more than sufficient to influence many other people to seek shelter there. Even in more normal situations, *social forces* such as these exert a powerful influence on our behaviours and beliefs. (See Psychology Around Us 13.1.) Often, for example, people conform to the behaviours and opinions of others, especially when those behaviours and opinions reflect a majority position. We will discuss the social forces of conformity and obedience in this section. First, though, let's examine the related topics of *norms*, *social roles*, *conformity*, and *obedience*.

Norms and Social Roles

In the aftermath of Vancouver's 2011 Stanley Cup final loss, many people arrived downtown after the game was over to join whatever social event was going to happen. Later, people around the country learned that a growing number of "sports fans" were burning cars and breaking into stores. Such reports made most people feel very unsettled. One reason for their discomfort was that such behaviours seemed to represent a breakdown of social values and compassion. Another reason was that the behaviours defied people's social expectations. Respectable citizens are not supposed to break into stores and carry off goods, and sports fans are supposed to celebrate or mourn their team's accomplishments without setting fire to vehicles. These expectations arise from the norms and roles of our society.

13.1 Psychology Around Us

More Than Tiredness

Yawning is contagious. Try it. If you have someone in the room with you right now, yawn (or fake a yawn), and see what happens (it's even more fun if you can pull it off with a group of people). Although this effect hasn't been studied specifically in humans, researchers at Emory University (de Waal & Preston, 2017; Campbell & de Waal, 2011) were able to trigger enhanced yawning in chimpanzees by showing them film footage of other chimpanzees yawning. The effect was two times larger if the chimpanzees in the movie were familiar to the chimpanzees watching the movie. Psychologists are not sure why this happens. Is it conformity? Social modelling? Peer pressure? Many social psychologists believe that contagious yawning may be a way of binding ourselves to other members of our group—that is, the sharing of an experience. More recently researchers from Liverpool (Amici, Aureli, & Call, 2014) replicated the results of the study from Campbell et al. and were also able to show that chimpanzees were not reactive when exposed to other actions such as scratching or wiping their noses; instead, increased reactivity was limited to contagious yawning. The researchers speculate that yawning may be linked to empathy. So if you yawn and a friend or colleague yawns right along with you, don't worry—you're not boring each other; you're sharing a moment.

Christian Hütter/imagebroker/Getty Images

Norms

Society is filled with rules about how everyone is supposed to act. These conventions, referred to as **norms**, provide order and predictability. Some norms are *explicit*, or stated openly. We all know, for example, that we are supposed to stop our car when we come to a red light. Other norms are *implicit*. These norms are not openly stated, but we are still aware of them. You probably weren't taught as a child to face the front of an elevator, for instance, but when is the last time you stepped into an elevator where all the passengers had their backs to the doors?

norms social rules about how members of a society are expected to act.

Richard T. Nowitz/Corbis/Getty Images

Pictorial reminder **This sign along a Newfoundland highway reminds drivers of the deadly physics of hitting a moose. It also helps remind people of the community's injunctive norm to drive responsibly. Such reminders often have a beneficial impact.**

We can also classify norms as descriptive or injunctive (Carcioppolo, Dunleavy, & Yang, 2017; Pedersen et al., 2017; Jeffrey et al., 2016; Panagopoulos, Larimer, & Condon, 2014). *Descriptive norms* are agreed-on expectations about what members of a group *do*, while *injunctive norms* are agreed-on expectations about what members of a group *ought to do* (see photo). Consider the behaviour of museum patrons, for example. The pristine appearance of the typical museum, along with signs throughout the building, regularly remind patrons not to litter in this setting. Virtually all museum goers abide by this rule, making it a descriptive norm (Kenrick & Goldstein, 2012). Other researchers have examined how norms influence behaviours and intentions. Smith and colleagues (2012) report that when injunctive and descriptive norms were in conflict, people's intentions (in this particular case) to engage in pro-environmental behaviours were weakened.

People are more likely to abide by injunctive norms if the norms are called to their attention. For example, people walking through a neighbourhood with litter cans and anti-littering signs are more likely to become aware of and follow the community's injunctive anti-littering norm. Simons-Morton et al. (2014) examined the effects of social norms on risky driving among adolescent males. Adolescent males were accompanied in a driving simulator by an age-matched peer who was either a risk-averse confederate or a risk-accepting confederate. Results indicated that adolescent males were more likely to engage in risky driving behaviours when accompanied by a risk-accepting peer. These results suggest a strong role for social influence in risky adolescent driving and indicate that some of the variability in adolescent driving can, in part, be accounted for by injunctive norms.

Social Roles

A **social role** is a set of norms ascribed to a person's social position—expectations and duties associated with the individual's position in the family, at work, in the community, and in other settings (Scheibe & Barrett, 2017; Yao & Moskowitz, 2015; Sarbin & Allen, 1968). The role of police officers, for example, is to maintain law and order. The role of parents is to nurture, rear, and teach their children and prepare them for life outside the family.

> **social role** a set of norms ascribed to a person's social position—expectations and duties associated with the individual's position in the family, at work, in the community, and in other settings.

Roles often have a positive impact on people and society. Indeed, they are critical for the smooth functioning of society. They can, however, also confine people. Just as many actors complain of being "typecast" and prevented from demonstrating their versatility, people in various positions are often limited by their prescribed social roles. Many observers argue, for example, that traditional Western gender roles are oppressive for women.

When individuals in a particular group try to step out of the social roles assigned to members of that group, they may be met with negative reactions and evaluations (Story et al., 2020; Clow, Ricciardelli, & Bartfay, 2014). For example, traditional Western gender roles ascribe more *communal* characteristics to women—that is, ones associated with the welfare of other people—and more *agentic* characteristics to men—that is, those associated with assertiveness, control, and confidence (Croft, Schmader, & Block, 2015; Johnston & Diekman, 2015; Szabo, 2014). In short, women in the West are expected to be caring and men to be assertive and self-assured.

Men and women are often judged harshly when they step outside their gender roles (Croft et al., 2015; Lindsey & Christy, 2011). For example, in heterosexual relationships, women who leave their children with the male ex-spouse following a divorce are judged more harshly than men who leave their children with their female ex-spouse (Allen, Wright, & Pietenpol, 2017; Harman et al., 2016). Gender role also impacts attitudes at work. Studies find, for example, that when female managers were described to research participants as "successful," the individuals rated the woman as more hostile, selfish, quarrelsome, and subjective than successful male managers; however, in top-level positions, women are often viewed more favourably than men in similar positions (Eagly et al., 2019; Paustian-

Underdahl, Walker, & Woehr, 2014; Koenig et al., 2011). Nevertheless, as already discussed, since only a very small proportion of women reach the upper echelons in business, the general opportunities for advancement in the business world are limited for women (Meroño-Cerdán & López-Nicolás, 2017).

In 2015, 80 percent of Canadian women between 25 and 54 years of age participated in the paid labour workforce, compared to just under 91 percent of men (Statistics Canada, 2017). As well, women are 1.6 times more likely to earn a bachelor's degree than men (Moyser, 2017). Nevertheless, on average, women occupy lower-ranking positions and earn less income than men, with women employed full-time earning an average of 87 cents for every dollar earned on average by men, though this may be partially influenced by time in position (Canadian Human Rights Commission, 2010). Women constitute only 4.4 percent of the chief executive officers (CEOs) in Fortune 500 companies, and 5 percent of CEOs in Fortune 1000 companies (Catalyst, 2014).

Males are also constrained by gender role expectations (Lowrance, 2014; Levant, 2011). For example, males are often portrayed negatively if they step outside of accepted gender role occupations (Stanley, 2012); are often viewed as occupying a marginal role in the family context (Tsai & Shumow, 2011); and are less likely to seek counselling because of the associated stigma around male control and loss of control (Vogel et al., 2014; Wester et al., 2010). The imbalance in opportunity and expectation needs to be addressed for both genders.

Roles, Gender, and Social Skills

There is a popular belief in Western society that, on average, women are more skilled socially than men, more sensitive emotionally, more expressive, and more focused on social relationships (Hine, 2017; Bodenmann et al., 2015). For example, in a wide range of social psychology studies, it has been found that female participants tend to read non-verbal social cues more accurately than male participants (Hall, Gunnery, & Horgan, 2016), are more expressive with their faces and bodies during interactions and better able to read subtle emotional expressions (Lawrence, Campbell, & Skuse, 2015), and feel more empathy for the emotional experiences of others (Paulin et al., 2014). For their part, male participants tend to focus more narrowly on the tasks at hand in group activities than do female participants, emerge as leaders (as opposed to social facilitators) in group activities, and adopt more authoritarian and less participative styles when they take on leadership roles (Koenig & Eagly, 2014).

Although researchers have not fully sorted out the issue, one of the most common explanations for these differences is social roles (Steinberg & Diekman, 2016; Kmec, O'Connor, & Schieman, 2014). As we observed above, traditional Western gender roles ascribe more communal characteristics to women—including expectations that they should be friendly, unselfish, concerned about others, and emotionally expressive—and more agentic characteristics to men—including expectations that they will be assertive, independent, and controlling. According to social role theory, people are inclined to behave in ways that are consistent with the expectations tied to their roles (Huffman & Olson, 2017; Huffman et al., 2014). Moreover, over the course of their lives, as people enact their social roles, their skills in the assigned realm become sharper and their corresponding attitudes more deeply ingrained.

Roles and Situational Demands: The Stanford Prison Experiment

As we have just discussed, social roles affect not only how others think about us, but also how we think about ourselves and how we act toward others. In 1971, Philip Zimbardo and his colleagues at Stanford University studied the power of situations and roles in a study famously known as *The Stanford Prison Experiment* (Zimbardo, 2016, 2006a, 2006b, 2004, 1972; Haney, Banks, & Zimbardo, 1973). At the time, Zimbardo said that it was his intention to conduct the study to show the power of the situation as a "bookend" to the Milgram study, described later in this chapter (Drury et al., 2012). He wanted to see what would happen to good people put into bad situations and he wanted the situation to be in a controlled experimental setting. The basement of the university's psychology department was converted into a mock prison, and 24 male students—all paid volunteers—were randomly assigned to play the roles of either prisoners or guards for what was supposed to be a period of two weeks. The situation was contrived to include elements such as coercive rules, differences in power, anonymity for guards, as well as deindividuated roles for prisoners (Zimbardo, 2007).

The researchers wanted the experiment to mimic the experience of an actual prisoner or guard as closely as possible. "Guards" were therefore given batons, uniforms, and mirrored sunglasses, and were told that it was their responsibility to manage the prisoners and to run the prison. Guards worked eight-hour shifts with breaks. "Prisoners" were arrested by police as they went about their daily lives, were fingerprinted, blindfolded, and deloused, were given prison garb (smocks without under clothing), and were forced to wear small chains around their ankles. Their belongings were taken from them and they were referred to by assigned numbers instead of by name. They were in prison 24 hours a day. On the second day, the prisoners rebelled. The rebellion was quickly quelled and the guards retaliated by stripping the prisoners naked, removing their beds from their cells, and putting the ringleader in isolation. The guards began to taunt and harass the prisoners, imposing humiliating emotional and physical punishments on them (e.g., forcing them to act out (but not actually execute) sexual acts on one another, chaining their legs together, forcing them to perform endless pushups), and denying bathroom privileges and food to prisoners who were deemed "out of line" but giving special privileges to those who were obedient (e.g., allowing smoking breaks for those they liked) (see photo). The prisoners began to respond to the guards with blind obedience. Prisoners later reported that within days of beginning the simulation they felt as if they had lost their old identities. Zimbardo (1972) said that the prisoners developed "zombie like attitudes and postures, [and were] totally obedient to the escalating guard demands."

Philip G. Zimbardo, Inc.

The power of social role playing **In the famous Stanford Prison Experiment, most of the students who were assigned to play prison guards engaged in at least some abuses of power, and some guards were deemed sadistic, while those assigned to prisoner roles typically became passive, depressed, and disorganized.**

Zimbardo reported that he acted more like a warden, concerned more with the security issues facing the "prison" than by the plight of his participants. Christina Maslach, Zimbardo's girlfriend (and later his wife) forced Zimbardo to see just how extreme the situation had become. Zimbardo (2007) said, "Christina made evident . . . that human beings were suffering, not prisoners, not experimental subjects, not paid volunteers." So, after six days, the experiment was called off. The study demonstrated the situational power of roles and context in behaviour and not only explains but *predicts* real-life situations such as those at Abu Ghraib Prison in Iraq where high stress environments with little surveillance by those in charge result in extreme abuses of power. Zimbardo (2007) said it best: "The situation won. Humanity lost." Each of us has to prevent situations like these from winning; each of us has to learn this lesson to keep the power of situations (and the systems in which they reside) from overriding a person's moral centre and good sense.

The Stanford Prison Experiment raised many ethical concerns in the field of psychology, primarily because the participants experienced clear psychological pain—both the prisoners, who were abused psychologically, and the guards, who were confronted with the fact that they were capable of cruelty and even sadism (Tolich, 2014). In addition, it has been suggested that the study itself, aside from ethical considerations, was not well designed and contained problematic demand characteristics which are build in pressures for participants to behave in particular ways (Le Texier, 2019). As you read in Chapter 2, there are now ethical guidelines and review procedures that all researchers must follow when conducting studies—guidelines and procedures that would make it impossible for this same study to be conducted today.

Conformity

Conformity is the tendency to yield to real or imagined group pressure. Investigators have been studying conformity for more than 70 years. Early work on this phenomenon was done by social psychologist Theodore Newcomb (1943). In a classic study, Newcomb examined the political views of students at Bennington College as they progressed through school. Although Bennington College is known for the politically liberal leanings of many of its faculty members, during the Great Depression in the 1930s it was attended largely by children from conservative families. Newcomb found that as the students progressed through college, immersed in the Bennington culture, their political views grew more and more liberal. Moreover, these liberal views endured well into late adulthood, confirmed by interviews conducted 25 and 50 years later (Alwin, Cohen, & Newcomb, 1991; Newcomb et al., 1967). Laboratory studies tell a similar story, especially the classic work conducted by social psychologist Solomon Asch.

conformity the tendency to yield to social pressure.

The Asch Studies

Imagine that you agree to participate in a psychology experiment on "perceptual judgments." You and six other participants are seated around a table—you are seated second from the end—and the experimenter presents two cards to the group. The card on the left, Card A, displays a single vertical line, whereas the card on the right, Card B, displays three vertical lines of various lengths (see **Figure 13.6**). The experimenter asks each participant which of the three lines on Card B is equal in length to the line on Card A. When it is your turn, you immediately recognize that the second line on Card B matches the one on Card A. Thus, after the five participants seated ahead of you indicate that the second line on Card B is equal in length to the line on Card A, you do the same. Another set of cards is presented, and again everyone agrees. The straightforward task is moving along easily and comfortably.

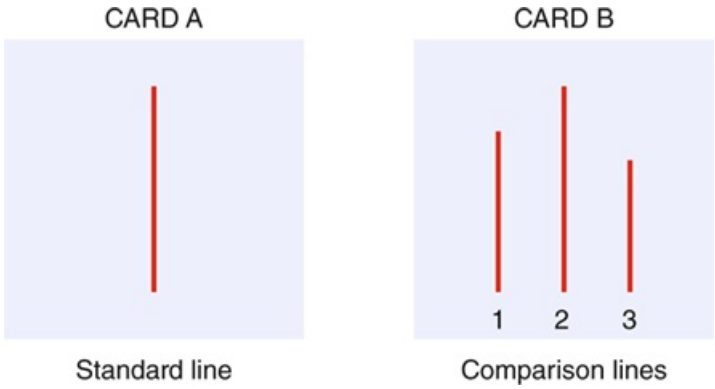


FIGURE 13.6 The perceptual judgment task in Asch's conformity study **Asch's participants were asked which line (1, 2, or 3) was the same length as the standard line. Despite the obvious and correct choice (line 2), when the confederates gave the wrong answer, almost 75 percent of the participants conformed and gave the wrong answer on at least one trial, too.**

Source: Adapted from Asch, S.E. (1955). Opinions and social pressure. ***Scientific***

American, 193(5), 31–35.

Then something odd happens. On the third round, you again readily note which line on Card B matches the line on Card A—it's pretty clear that it's line 3 this time—but you are shocked to hear that the first person called upon by the experimenter answers, "line 1." You think to yourself "he needs an eye exam," but then the second person responds the same as the first. You rub your eyes, blink, and squint, but still you see that it's line 3 that matches the length of the line on Card A. After the five people ahead of you have all selected line 1, it is your turn to respond. What will you say?

In fact, this classic study, conducted by social psychologist Solomon Asch (1955), was not about perceptual judgments at all, but rather was an investigation of conformity. In the study, the other "participants" were actually confederates, coached by the experimenter to give uniformly wrong answers on the third round and thereafter. Asch found that when the responses of the confederates were incorrect, almost 75 percent of the real participants conformed to the group norm and gave an incorrect response at least once.

Asch also varied the procedures in his experiment to reveal what group features might affect this "tyranny of the majority" (van den Bos et al., 2015), and others have followed with similar work. One key factor is group *unanimity*. The presence of even one dissenting group member dramatically reduces the likelihood that participants will conform to an incorrect group norm (Schmidt et al., 2016). The *size* of the group also affects its influence, as does the number of choices, with fewer choices leading to an increase in conformity (Curtis & Desforges, 2013). Groups with fewer than four members, for example, do not seem to bring about a powerful conformity effect (Asch, 1955; see **Figure 13.7**). Many laboratory studies on conformity have been conducted since Asch's pioneering undertaking (Bergquist & Nilsson, 2019; Beran et al., 2015; Kundu & Cummins, 2013). The findings of most such studies are similar to Asch's—they demonstrate the strong effects of social pressure.

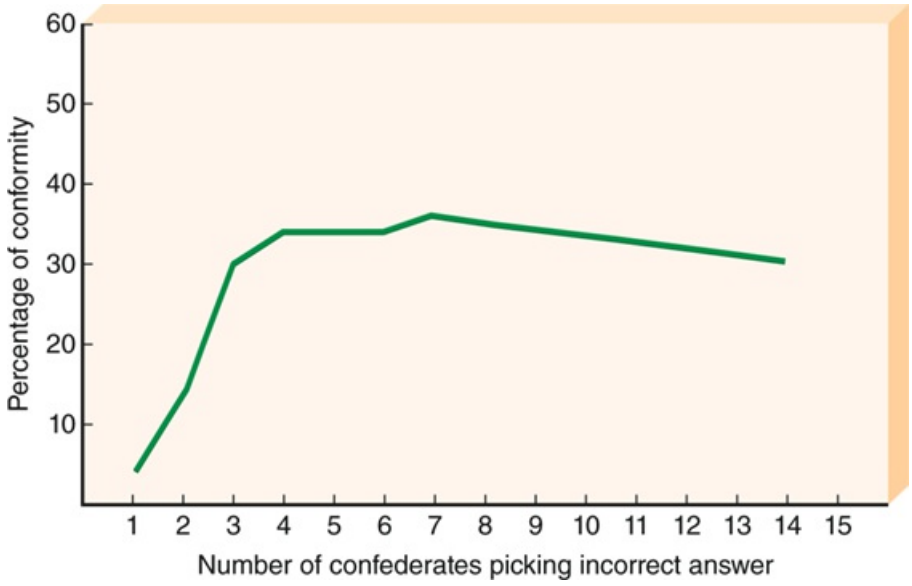


FIGURE 13.7 Group size and conformity **A key factor in conformity is group size. Asch found that the conformity effect is not strong when the group's size is less**

than four members (Asch, 1955).

Source: Adapted from Asch, S. E. (1955). Opinions and social pressure. *Scientific American*, 193(5), 31–35.

Conformity and Culture

Conformity is viewed very differently in individualistic and collectivistic cultures (Patil, Tetlock, & Mellers, 2016). People in individualistic cultures often consider conformity to be a bad thing. Typically, members of this kind of culture want to stand out and be different—to have their own identity. In contrast, those in collectivistic cultures usually value fitting in with other people. They see virtue in conforming to social norms and view conformity as an indication of maturity, respect for others, and appropriate self-control (Hodges, 2017; Marcus & Le, 2013). In fact, the Korean word for conformity means inner strength and maturity.

When ordering food in a restaurant, people in North America—an individualistic society—order whatever they desire. They may say, for example, "I'll have a Caesar salad, but light on the croutons and with the dressing on the side." However, in Korea, a collectivistic culture, that kind of restaurant etiquette would be viewed with disfavour. It would be seen as an inability to get along with others and as insensitive to the needs of the waiter. Thus, as you might expect, whenever Asch-like studies are conducted in collectivistic cultures, the participants show even higher rates of conformity than do participants in the North American studies (Mori et al., 2014). On the other hand, Bhawuk (2017) found that at least some of this higher rate of conformity in collectivist cultures may be more apparent than real because individuals may remain silent or non-responsive at times to appear to conform rather take an oppositional position. Although collectivist cultures show a stronger tendency to comply, there was no significant difference on measures of internalization in this research. Another example of cultural limits to conformity can be seen in how many Canadian Indigenous parents, particularly in the prairies strongly resisted their children' attendance at residential schools (see Indigenous Experiences 13.2).

13.2 Indigenous Experiences

Parent Resistance

For over 150 years, more than 150,000 Indigenous children, many taken against their will and the will of their parents and communities, attended residential school. Some never returned. Residential school attendance was required by law. Parents who resisted were threatened with jail or fines. Nevertheless, while some parents complied, many did not. Some parents fought back, sending their children to friends and relatives in distant communities, hiding them, or campaigning for local community schools (Stromquist & Knickerbocker, 2015). Before the amendment to the Indian Act in 1920, making it mandatory for all Indigenous children to attend school, some parents simply refused to send their children to school. For example, in 1897, in an Indian Affairs statement, one official reported that a Saulteaux Cree chief would "not allow his children to be sent to school, says he would sooner see them dead, and on every chance he gets speaks against education and the Industrial Schools provided by the

Government" (Ray, Miller, & Tough, 2000, p. 194, as cited by Truth and Reconciliation Commission of Canada, 2012, p. 49).

Many other examples of historical resistance on the part of parents have been recorded. One example is of a father visiting his daughter at her school and seeing another child whose legs had been shackled. He insisted that the principal remove the chains and said, "These are children, not criminals, and I don't ever want to see cruelty like this again" (Truth and Reconciliation Commission of Canada, 2012, p. 50). Over decades, parents began to work together and withdrew their children as a group to protest cruel treatment or neglect, and eventually began to hire lawyers (Stromquist & Knickerbocker, 2015).

Among the best examples of parent resistance is an event that occurred in 1970 at the Blue Quills Residential School, near St. Paul, Alberta. Indigenous children from 12 surrounding reserves attended the Blue Quills school where the children's languages and cultures were systematically undermined, and abuse was common. Only four people working at the school were Indigenous; no teachers were Indigenous. One of these employees, a parent, as well as a former student from the school, Stanley Redcrow, had children at the school but he took them home nightly because he knew that was when the worst abuses occurred. In 1969, Redcrow and Alice Makoik, at the Department of Indian Affairs, discovered that Blue Quills school officials were planning to sell the school to the government for $1 and that the Indigenous students would subsequently be assimilated into the surrounding public schools. Redcrow, Makoik, and other parents and community members formed the Blue Quills Native Education Council and asked the Department of Indian Affairs for control of the school so they could teach Indigenous children about their own culture and history. They were not successful (CBC, 2017). So, in July 1970, Redcrow and other parents and activists staged a sit-in at the school, demanding control of their children's education. The protest began with 60 people but quickly grew to 300. The sit-in continued for 17 days and ended with 20 representatives meeting with Jean Chrétien, then Minister of Indian Affairs. The operation of the Blue Quills school was subsequently transferred to the Native Education Council (CBC, 2017; Bashford & Heinzerling, 1987).

Source: Canada:The Story of Us/CBC

Resistance at Blue Quills Residential School In 1970, Stanley Redcrow and

other parents staged a 17-day sit-in at Blue Quills Residential School demanding to be given control over the operation of the school and their children's educations (as depicted by actors in Canada: The Story of Us: CBC, 2017).

The school reopened in 1971 with Indigenous faculty, courses taught in Cree, and language revitalization lessons in Cree. The new school mandate was to have "children progress in the white man's education, while continuing to retain their dignity and self-respect as Indian people" (CBC, 2017). According to a CBC article looking back at the historical significance of the parent resistance, "The success of Blue Quills turned the tide of Indigenous education in Canada toward Indigenous self-determination" (CBC, 2017).

Critical Thinking Questions

What were some of the ways that the early resistance of Indigenous parents to residential school was viewed by the mainstream population?

What does considering the actions of resisting Indigenous parents in relation to their cultural heritage add to our understanding of their actions that was missing prior to the Blue Quills sit-in?

What might be involved in the education of Indigenous children if the goal to have "children progress in the white man's education, while continuing to retain their dignity and self-respect as Indian people" were to be achieved?

Obedience

In the Asch studies of conformity, there were no leaders in the groups—just peers. In addition, there were no consequences for incorrect responses. No fines were imposed, nobody was hurt, and nobody had to account for or defend their decisions. But what about situations in which people are working under an authority figure, or in which they must pay a price for making an incorrect decision? Classic work by researcher Stanley Milgram offers important, and unsettling, insights into situations of this kind. Milgram studied **obedience**, which occurs when people follow direct commands, usually given by an authority figure.

obedience the act of following direct commands, usually given by an authority figure.

Milgram's Experiment

Milgram's (1963) study is perhaps the most famous and controversial experiment in the history of psychology. Imagine that you have agreed to participate in this experiment. You arrive at the designated location and are met by a stern-looking man in a lab coat. The man introduces you to the mild-mannered "Mr. Wallace" and explains that the two of you are participating in a study of the effects of punishment on learning. One of you will be randomly assigned the role of "teacher," and the other the role of "learner." You are then

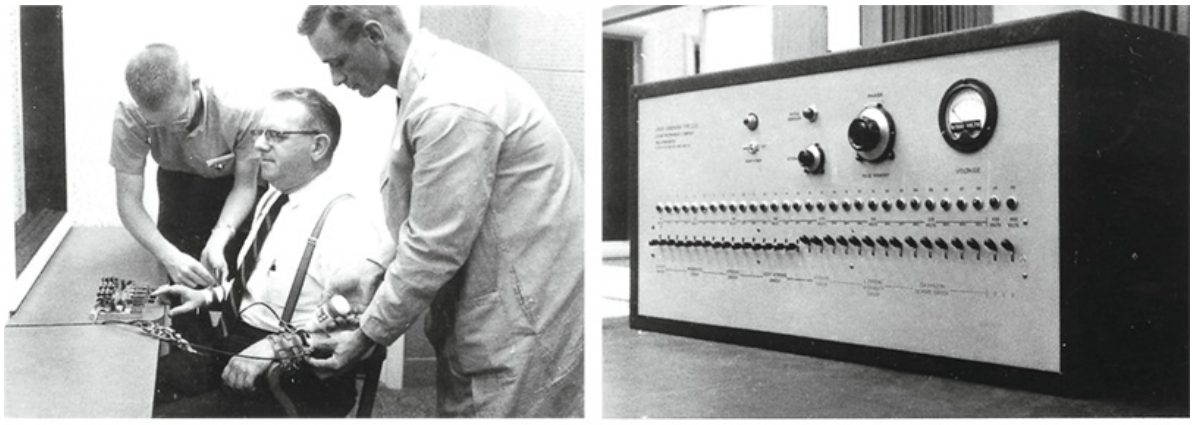
given the teacher role. Although you are not aware of it, the assignment of roles has not been random at all. Mr. Wallace is a collaborator in league with the experimenter who is really only interested in your behaviour.

The experimenter takes the two of you to an adjacent room, where Mr. Wallace is prepped for his role as learner. He is told to roll up his right shirt sleeve, and the investigator attaches an electrode to his wrist. His arm is strapped down "to prevent excessive movement," and electrode paste is applied "to prevent blisters or burns." You are informed that the electrode is connected to a shock generator in the other room (**Figure 13.8**).

The two of you are told that you (as the teacher) will recite a list of word pairs. After going through the entire list, you will recite only the first word of each pair, followed by four options. Mr. Wallace will indicate which option is the correct match for the first word by pulling one of four levers. If the response is incorrect, you will administer an electric shock. Mr. Wallace mumbles something about having a heart condition, but that comment is more or less ignored by the experimenter.

You are taken to another room, unable to see Mr. Wallace, and are seated in front of a metallic, box-shaped instrument, covered with knobs and switches and labelled "Shock Generator." You notice that each switch on the shock generator's control panel is identified by a voltage—ranging from 15 volts to 450 volts—and a label—ranging from "slight shock"(15 volts) to "danger: extreme shock" (375 volts) to "XXX" (450 volts). The experimenter explains that whenever you push down a switch, Mr. Wallace will receive the corresponding shock, and this shock will stop as soon as you push the switch back up.

You are to communicate with Mr. Wallace through a microphone intercom, as the rooms are "partially soundproof." When he responds by pulling one of the four levers, one of four lights on top of the shock generator will light up. You are to administer a shock to Mr. Wallace whenever he responds incorrectly. With each successive incorrect response, you are to move up one switch on the shock generator, administering what the labels suggest are increasingly powerful—and dangerous—shocks.



From the film Obedience ©1965 by Stanley Milgram. © Renewed 1993 by Alexandra Milgram. Distributed by Alexander Street Press.

FIGURE 13.8 Milgram's obedience experiment The photos above show the "teacher" helping the experimenter strap the "learner" into the shock apparatus and Milgram's shock generator. Most people believe that they would not administer shocks to a person crying out in protest, but Milgram's experiment

found otherwise.

After Mr. Wallace offers his first incorrect response, you flick the switch identified as "15 volts." The machine springs to life, with bright red lights flashing and an ominous buzzing noise filling the air. As Mr. Wallace continues to offer incorrect responses, you are instructed to administer increasingly powerful shocks. Through the wall, you can hear Mr. Wallace moan and say things, such as "Get me out of here!" Any time you express reluctance to go on, the experimenter confidently states "Please continue" or even, "You have no choice; you must go on." After a while, Mr. Wallace stops responding to your word prompts. The experimenter tells you to treat the failure to respond as an incorrect response and administer another shock (you're up to 450 volts, or "XXX," by now). Mr. Wallace lets out an agonized scream and yells, "Let me out of here! I have heart problems!" You hear and feel Mr. Wallace banging on the adjacent wall. Then he is completely silent. There are no further responses to your word prompts or to the shocks you administer.

As you are reading about this study, you are probably saying to yourself that you would have refused to go on with the experiment very early on. Most people who learn about this study have that reaction. Indeed, before the study became widely known, its procedures were described to psychologists, and they predicted that only 1 percent of participants would continue with the experiment all the way through 450 volts (Milgram, 1963). Astonishingly, Milgram found that 65 percent of the participants continued with the experiment all the way through the 450 volts label, and no participant stopped before the 300-volt mark (see **Figure 13.9**). As well, more recent replications of parts of the study (as the study as a whole would not receive ethics clearance today) show that things have not changed, and under similar circumstances participants would still behave as Milgram's initial participants behaved (Das, 2020; Blass, 2012).

The Milgram Controversy

It is no wonder that Milgram's study is one of psychology's most controversial. The study revealed something profoundly disturbing about human nature—namely, that we are inclined to obey authority, even if it means behaving in ways we would never predict we would behave. Milgram demonstrated that it is not just a cruel and sadistic fringe of the population that can inflict pain and suffering on innocent victims; two-thirds of the population might hurt others if ordered to do so by an authority figure. Milgram (1974) went on to explain the atrocities committed by Nazi Germany within the context of his remarkable findings, although a number of theorists have questioned the appropriateness of such a leap (Martin, 2016).

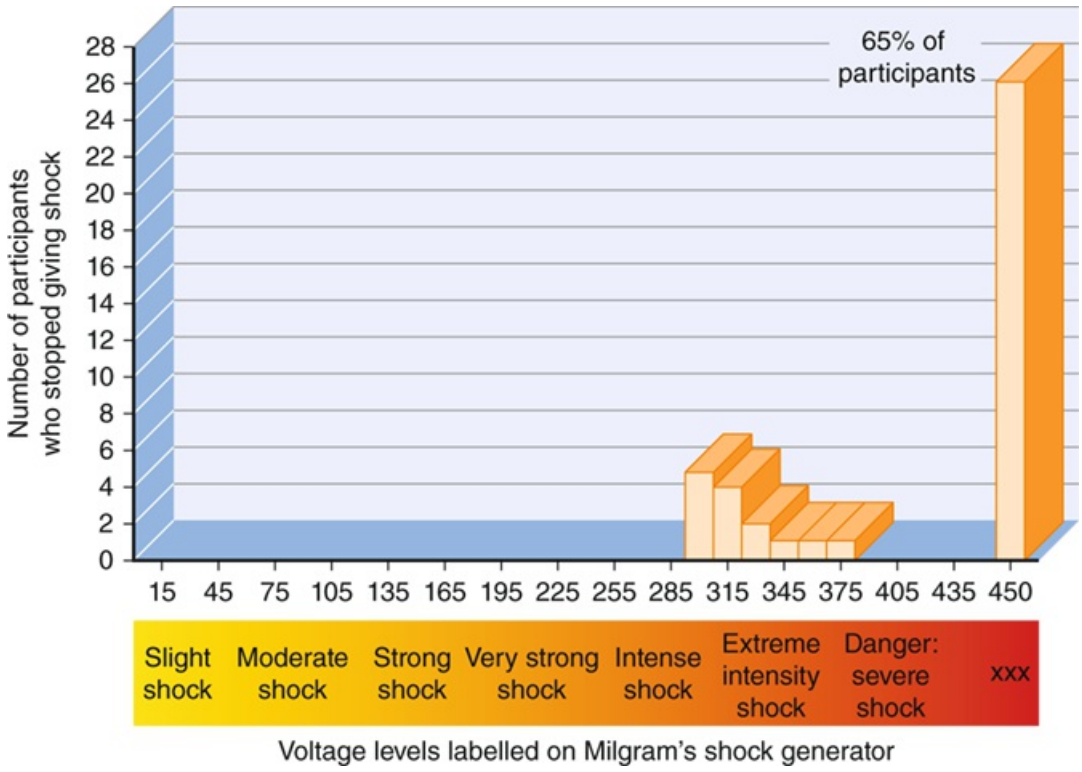


FIGURE 13.9 The results of Milgram's obedience experiment Milgram found that no participant stopped administering shocks before the 300-volt mark, and that the vast majority (65 percent) continued administering shocks to the highest level (Milgram, 1963).

Initially, many refused to believe that Milgram's findings provided an accurate representation of people's readiness to inflict suffering. Critics attacked the experiment on various grounds. Most notably, the participants in the original study were all male. Some speculated that women might be less inclined to obey commands to inflict pain on others. Additionally, a number pointed out that the study had been conducted at Yale University. Had it been carried out at a less prestigious locale, they argued, the participants might have been less likely to obey the experimenter's commands. Finally, many questioned the ethical implications of the research (Gibson, 2019; Griggs, 2017).

Follow-Up Studies

Milgram spent the years following the publication of his controversial findings conducting variations of the original experiment to further clarify the nature of obedience (Milgram, 1974). To the surprise of many people, he found that female participants were no more likely to defy an experimenter's commands than the male participants in the original experiment. Milgram also set up an alternative site for his experiment, the "Research Associates of Bridgeport"—supposedly a commercial organization that was not connected with Yale. In this variation, the percentage of people who kept administering shocks through 450 volts was somewhat lower than in the original experiment, but still considerable—around 50 percent, compared with the original 65 percent.

Further to that, a meta-analysis carried out by Haslam and colleagues (2014) to evaluate

factors impacting the original findings identified eight factors that predicted whether a given individual would go all the way to the 450 volt level of shock. Factors included the proximity of the experimenter to the person in the role as the teacher, as well as factors related to the connection between the teacher and the learner (e.g., three factors were related to the experimenter: how directive they were, how legitimate they were perceived to be, and how consistent they were). As well, if there was group pressure on the teacher to disobey, or proximity was indirect, the teacher's behaviour was also impacted. Finally, the behaviour of the teacher was influenced by proximity and amount of intimacy between the teacher and the learner and the distance between the experimenter and teacher.

Milgram's experiments and subsequent replications demonstrated just how ready people are to obey authority, but they also clarified that certain factors *reduce* people's willingness to obey (Hollander, 2015; Burger, 2014).

> If a confederate served as "co-teacher" with the research participant and refused to continue, over 90 percent of the real participants followed suit and disobeyed as well.
>
> The *salience* of a victim's suffering—its obviousness—affected participants' obedience. Participants in Milgram's studies were, for example, less likely to obey when they could see the look on Mr. Wallace's face with each successive shock.
>
> A participant's *proximity* to the victim affected obedience. When Milgram's participants were seated in the room with Mr. Wallace, only about 40 percent of them continued to obey through 450 volts. Still fewer (30 percent) were obedient in a condition that had them placing Mr. Wallace's hand on a shock plate to administer the shock.

Of course, there are many occasions in life where it can be quite useful, and even advantageous, to obey commands. During military manoeuvres, surgical procedures, theatre productions, and sporting competitions, for example, a lack of obedience may result in chaos or disaster. However, Milgram's study demonstrates the dark side of obedience. In a letter to another social psychologist, Milgram wrote, "Certainly, obedience serves numerous productive functions, and you may wonder why I focus on its destructive potential. Perhaps it is because this [the holocaust] has been the most striking and disturbing expression of obedience in our time" (Blass, 2004, p. 99).

It is important to note that Milgram's work was carried out in 1961 and 1962, prior to the advent of institutional ethics review boards. Yale University did not require informed consent from participants at that time. Instead, participants provided uninformed verbal consent and signed legal documents absolving Yale University of any liability. This type of research would not be allowed today (Howe, 2018; Haslam et al., 2014).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

10. What are norms and what is their function in society?

11. What did Solomon Asch's experiments on conformity reveal?

12. What is the central difference between the concepts of conformity and obedience?

What Do You Think? • In both Asch's and Milgram's experiments, the presence of another person who would either go against the group or refuse to obey the authority figure made it more likely that the research participant would do so as well. How would you explain this phenomenon?

Social Relations

LEARNING OBJECTIVE 4

Review major concepts in the areas of group dynamics, helping behaviour, aggression, and interpersonal attraction.

Many social psychologists are interested in social relations. Some have studied *group dynamics*—how membership or participation in a group influences our thoughts and behaviours. Still others have attempted to determine when people choose to help others and when they will ignore others' needs. Other social psychologists have examined aggression and interpersonal attraction, trying to understand why people behave aggressively and how people come to like or love others in their social world.

Group Dynamics

A **group** is an organized, stable collection of individuals in which the members are aware of and influence one another and share a common identity. Group members are thus *interdependent*—that is, the behaviour of one group member affects the behaviour of the other members (see photo). Let's consider several topics related to groups and group dynamics: *group productivity*, *the social facilitation effect*, *social loafing*, *group polarization*, and *groupthink*.

group an organized, stable collection of individuals in which the members are aware of and influence one another and share a common identity.

Caiaimage/Sam Edwards/ OJO+/Getty Images

Group dynamics **Membership or participation in a group influences our thoughts and behaviours.**

Group Productivity

One issue of interest to social psychologists is what makes groups productive. Not surprisingly, they have found that the optimal group size for productivity depends on the task at hand.

When a group is performing an *additive task*, its members must perform parallel actions. For example, to clear a property of snow after a storm, all members of a work crew must shovel snow. For such tasks, group productivity increases directly with group size.

In contrast, when a group is faced with a *conjunctive task*, the members are only as productive as the weakest member. If, for example, group members are hiking together up a mountain, they can travel only as fast as the slowest person in the group. In this situation, a greater number of group members does not necessarily yield better performance.

A *disjunctive task* requires a single solution. In such undertakings, the most competent person in the group is likely to provide the solution. Larger groups are typically more productive for disjunctive tasks, because a larger group is more likely to have a superstar member who can solve the problem at hand. Often large groups start by brainstorming for a solution to a task or problem. Asking group members to generate as many possible ideas or solutions as they can without being in any way critical of ideas proposed by others is a wonderful way to gather a broad range of possible solutions, and increases the likelihood that a useful solution will be found.

Divisible tasks involve the simultaneous performance of several different activities. When groups confront such tasks, no single person works on all phases of the undertaking; thus, the different strengths of group members complement one another. For divisible tasks, larger groups tend to be more productive, provided someone or a

part of the group manages or coordinates the activities of different parts of the group as they work on the components of the larger group task.

Video **PSYCHOLOGY@WORK**

Groups and Teams **This video looks at recent industrial/organizational psychology work on how teams function and how teams can be set up and supported in order to succeed. The video shows the value that corporate recruiters place on a person's ability to work in teams.**

Teams and groups are very important within organizations and workplaces these days. In fact, the ability to work well in a team setting is one of the most sought-after qualities in potential new hires (Jones, Baldi, Phillips, & Waikar, 2017). Industrial organizational psychologists study the factors that influence team engagement and performance. Check out the Psychology@Work video on Groups and Teams to find out more and also check out Practically Speaking 13.1.

Social Facilitation

In many instances, our performance is enhanced when we are in the presence of others. This is one of the oldest observations in social psychology. In the late 1890s, psychologist Norman Triplett noted that cyclists tend to go faster when in the presence of other cyclists than when alone—even when they are not in competition with one another (see photo). To test his hypothesis that the presence of others can enhance individual performance, Triplett (1898) conducted an experiment in which he had children wind a fishing reel either all alone or side-by-side with other children. Triplett found that children winding side-by-side worked substantially quicker than children winding by themselves. This phenomenon was later labelled **social facilitation**. Its study was expanded to include not just physical tasks, but also mental tasks, such as solving puzzles and doing math problems (Bond & Titus, 1983).

social facilitation an effect in which the presence of others enhances performance.

Stefano Rellandini/IOPP Pool/Getty Images

Improving each other's performance **Former Canadian Olympic cyclist Clara Hughes (front right) leads the pack during the women's cycling road race at the London 2012 Olympic Games. Research indicates that cyclists tend to go faster in the presence of other cyclists than when alone—the result of social facilitation.**

As social facilitation has been studied over the years, researchers have learned that people's performance in the presence of others is more complicated than Triplett first believed. Psychologist Robert Zajonc (1965) proposed that the presence of others elevates our arousal level, which in turn facilitates performance on simple, well-learned tasks, but interferes with performance on complicated tasks. In fact, research evidence supports this suggestion. For some tasks, and for some people, performing in the presence of others can impair—rather than enhance—performance (Monfardini et al., 2016; Yu & Wu, 2015). Zajonc's theory has received support from numerous studies and observations of both humans and animals (Rosenbloom & Perlman, 2016; Reynaud et al., 2015).

In recent years, theorists have focused less on the mere presence of others and more on individuals' *interpretations* of and *reactions* to the presence of others (Steinborn & Huestegge, 2020; Davidson & Keene, 2019; Varvatsoulias, 2016). If, for example, individuals do not like or trust other people in their group, their own contributions to a group project may suffer. In addition, if people believe that other group members are disregarding their ideas or efforts, their own performance in the group may decline (Baumeister, Ainsworth, & Vohs, 2015; Fiske, 2010).

13.1 Practically Speaking

Group Work to Teamwork

You have probably been in more than one or two courses that include a group project or group presentation as part of their required graded components. Did you enjoy the group work? If you said no, you are certainly not alone. Most students feel that group work puts them in a position where they are not in control of their course outcomes

(Allan, 2016). Before your next group project comes along, consider that when interviewing potential new employees, recruiters for organizations currently place the ability to work well in teams and related social (emotional intelligence) skills such as getting along well with others at or near the top of their wish lists—significantly higher than GPA and work experience (Jones, Baldi, Phillips, & Waikar, 2017). Very few colleges or universities offer courses or direct training in these sorts of soft skills (Gibert, Tozer, & Westoby, 2017). What to do?

Tom O'Neill is an industrial/organization psychologist at the University of Calgary who studies the links between group work and teamwork. He looks at ways that students can increase the short-term mark payoffs and longer-term employability payoffs through their participation in group course projects. His research provides some suggestions of things you can do to improve your group work experiences and marks and how you can add to your teamwork resumé along the way.

The first step is to pay attention to the different types of conflicts that arise during group work and teamwork projects (O'Neill et al., 2018a). Relationship conflicts occur when group members do not get along due to personality differences. The solution to these sorts of conflicts is to start by asking all group members to agree, up front, to be professional in their interactions with one another. Process conflicts arise when the group does not have a clear plan laid out for how the project will proceed. The solution is to work out a meeting schedule and obtain group agreement on project steps at the very beginning. Task conflicts involve disagreements about the details that are the core work of the project. To avoid task conflicts, O'Neill suggests using the four steps of a process called "SUIT." Group members are assigned group task components to gather information and work on and report back to the group. Each member then shares (the "S" in SUIT) what they gathered clearly with the group. The group listens closely and asks questions with the goal of understanding ("U") what each member presents and then works together to integrate ("I") the information gathered and ideas presented by each group member. Lastly, they make a team ("T") decision about how to proceed with their project (O'Neill et al., 2017).

Does this approach work? O'Neill found that groups that began by agreeing to put relationship conflicts aside, dealt with process conflicts up front, and focused on resolving task conflicts consistently got higher marks than did groups that spent more time struggling with relationship and process conflicts and did not get focused on task conflicts (O'Neill et al., 2018b).

How do you take your group work experiences with you so you can talk about your teamwork skills in job interviews? Once the group project is done, do a group or an individual (if the rest of the group is not interested) debriefing in which you review how the group managed the components of the SUIT process. As well, reflect on things that you or the group might have done differently that could have enhanced group performance (Eddy, Tannenbaum, & Mathieu, 2013; Lacerenza, Marlow, Tannenbaum, & Salas, 2018). The last step is to write your thoughts down because recruiters are not going to just ask if you work well in teams—they are going to want specific examples. If you keep your reflective debriefing notes, you will have a story or two to tell that will verify your teamwork and social skills. Good luck!

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Social loafing **Social loafers leave the work of a collective task to others in the group.**

Social Loafing

Groups are often formed in hopes that an interconnected body of people can energize and motivate every individual member. However, these hopes are not always realized. When working in a group, how many times have you noticed that one or two of the group

members are not pulling their weight? **Social loafing**—also known as *free riding*—refers to the phenomenon in which people exert less effort on a collective task than they would on a comparable individual task (Byun, Lee, Karau, & Dai, 2020; Czyż et al., 2016; Simms & Nichols, 2014). (See photo.)

> **social loafing** a phenomenon in which people exert less effort on a collective task than they would on a comparable individual task; also known as free riding.

Social loafing seems to rear its ugly head most often in large groups (Cummings et al., 2013). It is most likely to occur when certain group members lack motivation to contribute, feel isolated from the group, calculate the cost of contributing as too high, or view their own contributions as unnecessary (Meyer, Schermuly, & Kauffeld, 2016). Research suggests that people from Western cultures are more inclined to display social loafing than people from Eastern cultures, and men are more likely to do so than women (Simms & Nichols, 2014).

Fortunately, social loafing can be minimized. When, for example, groups are highly *cohesive*—when group members all desire and value membership in the group—the social loafing phenomenon all but disappears (Meyer et al., 2016; Schippers, 2014). Additionally, social loafing is reduced when group members are each explicitly reminded of their uniqueness and importance (Tsay et al., 2014), when they are given specific and challenging goals (Schippers, 2014), when the output of each member is publicly identified, and when the members are given clear norms and comparison standards for their work (De Backer et al., 2015; Takeda & Homberg, 2014). Finally, alertness tends to decrease social loafing, whereas fatigue tends to increase it.

Group Polarization

Have you ever begun talking about one of your favourite bands with a group of friends with similar musical tastes, and found yourself liking the band even more by the end of the conversation? When an initial tendency of individual group members is intensified following group discussion, **group polarization** occurs (Sieber & Ziegler, 2019; Evans, 2017; Roux & Sobel, 2015; Isenberg, 1986). This phenomenon is not simply an example of conformity. With group polarization, the attitudes and inclinations of the individual group members are already in place, and they become more intense and more extreme as a result of the group interaction (Effron & Knowles, 2015).

> **group polarization** the intensification of an initial tendency of individual group members brought about by group discussion.

Group polarization has been studied most often with regard to racial and ethnic bias and social and political attitudes (Effron & Knowles, 2015; Iyengar & Westwood, 2015). When, for example, researchers have placed individuals with highly prejudiced attitudes in a group to discuss racial issues, the attitudes of the individuals tend to become still more prejudiced (Willis, 2017; Myers & Bishop, 1970). In similar work, it has been found that the attitudes of women with moderate leanings toward feminism become more strongly feminist following group discussions (Kolers, 2016).

Groupthink

Groups often come together to solve specific problems and make decisions. We noted earlier that group cohesiveness can prevent social loafing—but sometimes, groups can become *too* cohesive and single-minded, and the group's decision making can lead to disaster. A classic example occurred in the early 1960s, when the Kennedy administration in the United States government was determined to overthrow Fidel Castro's Communist government in Cuba. The U.S. government had trained a small group of Cuban exiles as part of a military operation to overthrow Castro. Proponents of the plan predicted that once this small militia touched down in Cuba at the Bay of Pigs, the Cuban citizens would rise up and join them. Instead, the operation collapsed, with no support from the Cuban people and no further help from the U.S. government. As a result of the failed invasion, anti-American sentiment around the globe increased, as did Castro's influence in Latin America, and Cuba's ties with the Soviet Union were strengthened. There is evidence that no one within Kennedy's inner circle raised any concerns about the viability of the plan in part because they were focused on finding a solution that would please the president. There was a strong sense of shared certainty that the Cubans would rise up and support the small invasion force (Janis, 1972).

NASA/Getty Images

A consequence of groupthink? In 2003, the space shuttle Columbia disintegrated during re-entry over Texas, killing all seven crew members. Just two days before the disaster, a NASA engineer had warned his supervisors of possible catastrophes on re-entry, but his message was not forwarded up the chain of command. How might groupthink have been involved in this mishandling of the warning?

Psychologist Irving Janis (1972), after examining the flawed decision-making process that went into the Bay of Pigs invasion, attributed the fiasco to what he termed **groupthink**. He defined groupthink as a form of faulty group decision making that relies on overfocused and biased thinking and occurs when group members reach premature conclusions in a

misguided effort to achieve unanimity (see photo). The goal of achieving a consensus among all group members overrides the need to realistically appraise alternative courses of action. Clearly, groupthink can have undesired consequences (Mintz & Wayne, 2016, 2014; Sunstein & Hastie, 2015). The botching of the Bay of Pigs incident increased tension between Russia and the United States and was a factor in precipitating the Cuban Missile Crisis.

> **groupthink** a form of faulty group decision making that occurs when group members strive for unanimity, and this goal overrides their motivation to realistically appraise alternative courses of action.

Janis identified a number of conditions that set the stage for groupthink: (1) strong similarity in group members' backgrounds and ideologies; (2) high group cohesiveness; (3) high perceived threat; (4) elevated stress; (5) insulation from outside influence; and (6) a directive, often charismatic, leader. As a result of these conditions, group members experience an illusion of invulnerability and have an unquestioned belief in the group's inherent morality. Typically, group members exert direct pressure against any member who expresses strong disagreement, and members protect the group from information that might shatter the shared conviction that their decisions are effective and moral (Janis, 1982). See Psychology Around Us 13.2 to read an example of the result of a disastrous decision-making effort at the National Aeronautics and Space Administration (NASA).

Having identified the phenomenon of groupthink, Janis went on to propose measures that a group can take to safeguard against it. First, the leader of the group should encourage members to air objections and doubts, and should accept criticisms of the group's judgments. Additionally, various group members should be assigned the role of "devil's advocate," arguing against the group's favoured position. Finally, outside experts should be invited to group meetings and encouraged to challenge the group's core views and decisions.

U.S. President Kennedy learned from his mistakes with the Bay of Pigs invasion. When faced with evidence of Soviet ballistic missile sites in Cuba in 1962, Kennedy used a much different approach to decision making, adhering to many of the safeguarding measures subsequently suggested by Janis. As the world teetered on the precipice of nuclear war during the Cuban Missile Crisis, the president established an Executive Committee of the National Security Council headed by the vice-president and the attorney general to determine a course of action. Kennedy gave committee members time to gather information and explore options. He then recused himself from their meetings so as not to inadvertently direct the recommendations, but without their knowledge, he tape recorded their meetings for review purposes. He instructed the attorney general to act as "devil's advocate," forcing the members to discuss and debate the merits of different strategies for the group. After 13 days, an atomic confrontation was narrowly averted. Why is such an old event covered in such detail here? At the time of writing, North Korea's leader and the then-president of the United States could have been facing a similar crisis.

13.2 Psychology Around Us

Space Disasters and Groupthink

"On the morning of January 28, 1986, the space shuttle Challenger blasted off from the Kennedy Space Center in Florida. Seventy-three seconds after lift-off, the Challenger exploded, killing all seven astronauts on board . . . Following the explosion . . . information came to light about the faulty decision-making processes . . . that [had] led to the decision to launch. Some engineers had expressed concerns about the design of the O-ring seal in the solid-fuel rocket, which could allow hot gases to leak through the joint and thereby spark an explosion. However . . . these concerns were ignored . . .

"Unfortunately little was learned from this tragic accident because many of these same errors contributed to the loss of the Columbia space shuttle, and its seven astronauts, on February 1, 2003 [the shuttle was trying to return to earth after a 16-day mission in space]. Research now shows that prior to the Columbia disaster, some NASA engineers had grave concern about the shuttle's ability to return to earth following some tile damage it [had] experienced on lift-off. On January 28, just days before the Columbia tragedy, a landing gear specialist at NASA sent an email expressing his concerns about the tile damage . . . However, high-level NASA administrators viewed the damage to the shuttle as minor—not a serious threat—and refused to respond . . ." (Sanderson, 2010)

Research conducted since Janis first proposed his theory suggests that groupthink is a complicated phenomenon—probably more complicated than Janis initially realized. The conditions that he believed set the stage for groupthink do not always result in unwarranted unanimity (Sethi, 2017; Houghton, 2015). Nor do his proposed safeguards always prevent groupthink. At the same time, research and observations clearly indicate that the phenomenon of groupthink is widespread. Not only does it often affect decision making in important policy-setting groups, as Janis recognized, but it also influences decision making in mundane and temporary groups and groups working on trivial matters (Stingl & Geraldi, 2017; Frey, Schulz-Hardt, & Stahlberg, 2013).

Helping Behaviour

When people are in need, many people offer help as an expression of **altruism** (concern for or acting to help others without any expectation of compensation or reciprocation) or of another social motive. In 2016, while the displaced and anxious evacuees from Fort McMurray, Alberta, watched in horror as their city burned due to a raging wildfire, offers of accommodation, assistance, and aid poured in from across Canada. Residents of Fort McMurray, while devastated by their losses, felt supported and cared for by their fellow Canadians. Other examples of altruism that have inspired others include Terry Fox's run for cancer, Rick Hansen's Man in Motion world tour in support of spinal cord research and the HumboldtStrong response to help families affected by the tragic loss of 16 members of the Humboldt Broncos hockey team in a bus collision in Saskatchewan in April 2018. All of these selfless accomplishments have led to many more altruistic activities, with many people across Canada and around the world participating in Terry Fox runs every year.

altruism self-sacrificing behaviour carried out for the benefit of others.

Why Do We Help?

Altruism refers to self-sacrificing behaviour carried out for the benefit of others. To be altruistic, behaviour must be motivated by concern for persons in need, without concern for oneself (Feigin, Owens, & Goodyear-Smith, 2014; Moorlock, Ives, & Draper, 2014). Thus, engaging in self-sacrificing behaviour to avoid a sense of guilt or donating to charity for tax purposes would not be considered altruistic behaviour. Such acts, which are motivated by a desire to reduce one's own personal distress or to receive rewards, are sometimes called *egoistic helping behaviours* (Siem & Stürmer, 2018; Dickert, Västfjäll, & Slovic, 2015).

Albert Gea/Reuters

Responding to tragedy **Almost immediately after a series of terrorist bombs ripped through passenger trains in Madrid, Spain in 2004, killing 191 people and injuring 1800 others, Spanish citizens such as these began lining up to donate blood to the victims. Altruism? Possibly. But social psychologists point out that egoistic motives may also be at work during the early reactions to tragedies of this kind.**

When we engage in helping behaviour, our motives can be entirely altruistic, entirely egoistic, or some combination of the two. Surveys have revealed that in the *immediate* aftermath of the 9/11 terrorist attacks, actions such as giving blood, money, and goods and offering prayers were associated with both altruistic and egoistic motives (Chung et al., 2016). (See photo.) People's motivations for giving ranged from wanting to ease the suffering of others, to hoping to reduce their own attack-induced distress and seeking to reassure themselves that other people would help them if they were in need. In contrast, *sustained* giving after the attacks—that is, giving after one or more years—may have been more consistently associated with altruistic motives.

Research further indicates that certain factors increase the likelihood of altruistic behaviour. When people empathize and identify with the individuals in need (Atabaeva, 2019; Lemmon & Wayne, 2015), as well as when they are in close relationships (Mikulincer & Shaver, 2017; Xue, 2013), they are more likely to behave altruistically. Similarly, people tend to display more altruism when they take the perspective of victims (van Loon et al., 2018; Feigin et al., 2014). Not surprisingly, then, people who are generally trusting and outward-looking and who form secure attachments in their relationships are most likely to

perform altruistic behaviours (Paulus et al., 2016; Lozada, D'Adamo, & Carro, 2014). As you can see, it is often quite difficult to identify and understand the specific motives that drive people's helping behaviour, and especially to determine if their behaviour can be seen to be truly selfless and thus truly altruistic. Questions about the existence and nature of altruism have been taken up as central interests by psychologists working in the area of positive psychology (Batson, Lishner, & Stocks, 2015).

Positive psychology is the scientific study of the strengths and virtues that help human beings, as individuals and families, to thrive, and communities to flourish (Krumrei-Mancuso, 2017). Researchers in this field argue that other approaches to psychology focus on dysfunction and abnormal behaviour and, while they acknowledge the importance of remedying problems, they also argue that focusing on strength is as important as focusing on weakness. They believe that focusing on well-being is as important as focusing on suffering. Martin Seligman, widely regarded as the father of positive psychology, believed that the time was right for a scientifically-informed psychology about positive human functioning. Positive psychologists study empathy (Lasota, Tomaszek, & Bosacki, 2020; Prot et al., 2014), altruism (Valsala & Menon, 2019; Batson, 2014), gratitude (Emmons, Froh, & Rose, 2019; Tsang et al., 2014), resilience (Hogan, 2020; Luthar, Lyman, & Crossman, 2014), mindfulness (Lomas et al., 2019; Kashdan & Ciarrochi, 2013), and happiness (Eckhaus & Sheaffer, 2019; Argyle, 2013), as well as other areas they claim make life more worth living (Compton & Hoffman, 2019). A good example of Positive Psychology research involves how giving to others or prosocial giving makes donors feel (see Positive Psychology 13.2).

Bystander Effect (or Bystander Apathy)

Imagine you are in a life-threatening situation and desperately need the help of others. If you could choose, would you prefer that one or two people were nearby or that a large number of people were present? If you are like most people, you probably would prefer the larger number. After all, that would mean more potential helpers. In fact, however, this may be the more dangerous choice. It turns out that, in many circumstances, the more people present in a situation where help is required, the less likely it is that any one person will give that help (Doramajian & Bukowski, 2015; Hortensius & de Gelder, 2014; van Bommel et al., 2014).

13.2 Psychology Around Us | Positive Psychology

Prosocial Spending and Happiness

Social psychology researchers often study the effect that money has on happiness. Most people are surprised to find out that even the perception of wealth can impair a person's ability to appreciate simple daily experiences, such as enjoying a smooth, rich, dark (or milk if that's your preference) piece of chocolate (Quoidbac, Dunn, Petrides, & Mikolajczak, 2010). This decreased ability of participants to truly savour the effects of wealth on enjoying an everyday experience led Elizabeth Dunn, at the University of British Columbia, to start studying the effects of prosocial spending on happiness. Research from her laboratory, published in the prestigious scientific journal *Science*, has shown that people who spend money on others report increased happiness,

especially when that money is spent on people you feel strongly connected to socially (Aknin, Sandstrom, Dunn, & Norton, 2011; Dunn, Aknin, & Norton, 2008). This effect of prosocial spending on happiness can be observed around the world, and has even been reported in toddlers (Aknin et al., 2013; Dunn, Aknin, & Norton, 2014). The effect of prosocial spending appears to be strongest in individuals who already feel concern for others outside of themselves (Hill & Howell, 2014). Whether this increase in happiness due to prosocial spending lasts for more than a few days is currently debated (Falk & Graeber, 2020). However, the general consensus seems to be that prosocial spending does give, at least in the short term, a happiness boost.

Frederic Stevens/Getty Images

Helping our world one disease at a time **Two individuals who are well-known for their prosocial spending are Bill Gates, a co-founder of Microsoft, and his wife Melinda. The Bill and Melinda Gates Foundation is known for its funding of initiatives that support gender equality, access to contraceptives, climate change action, and the eradication of global diseases such as AIDS. They are pictured receiving the prestigious Légion d'Honneur medal in Paris for their charity work around the world. Despite the possible effects of this level of prosocial spending on happiness, the Gates announced in 2021 that they were divorcing suggesting that the relationship between prosocial spending and happiness is complex.**

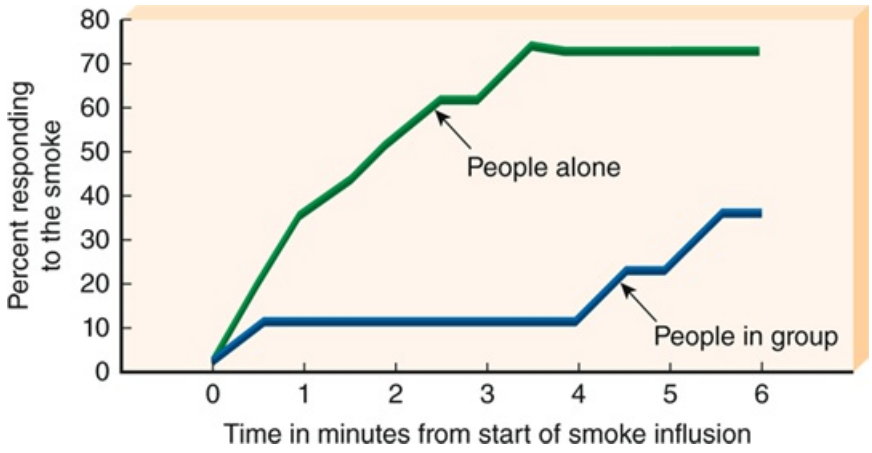

FIGURE 13.10 Bystander intervention People are more likely to intervene to help when they are alone than in a group. In the presence of others, people feel less compelled to act, a phenomenon called the *bystander effect* (Darley & Latané, 1968).

Source: Adapted from Myers, D. G. (2002). *Social psychology* (7th ed.). New York: McGraw Hill, Figures 3-2 and 12-4; based on Darley, J. M., & Latane, B. (1968). Bystander intervention in emergencies: Diffusion of responsibility. *Journal of Personality and Social Psychology, 8*, 377–383.

Consider the following story: on March 13, 1961, a woman named Kitty Genovese was purportedly stabbed to death over the course of three separate attacks spread over 30 minutes in the New York borough of Queens, while at least 38 neighbours and other onlookers failed to intervene. This rendition of a famous murder was followed by a public outcry demanding an explanation for the lack of intervention by others, including a *New York Times* article with the headline: "Thirty-Eight Who Saw Murder Didn't Call the Police" (Gansberg, 1964). Initially, many observers concluded that these 38 bystanders must have had a host of personality flaws that prevented them from helping. But were they really callous and uncaring?

Social psychologists John Darley and Bibb Latané (1968) were less interested in the personality traits of these onlookers than with features of the situation that might have kept them from providing help. In a series of studies examining the impact of the presence of others on helping behaviour, Darley and Latané repeatedly demonstrated that we are, in fact, more likely to intervene when we are *alone* than when others are also present. In one of their studies, for example, participants found themselves in a situation where they smelled smoke (faked by the experimenters) while either alone or in the presence of others. When other people were present in the room, fewer than 40 percent of the participants got up to report the smoke; in contrast, 75 percent of the participants in the study reported smelling smoke when they were alone in the room (see **Figure 13.10**) (Latané & Darley, 1968). In another experiment by the two researchers, participants were placed in a situation in which they overheard a person (actually an actor) in another room having a seizure. The more people the participants believed could also hear the individual having the seizure, the less quickly they acted to help (Darley & Latané, 1968).

This phenomenon has been termed *bystander effect*. If your car is broken down in the rain

at the side of the road and no one is stopping to help, you may be experiencing firsthand the bystander effect. Researchers in addition to Darley and Latané (1968) have observed group bystander effects of this kind under a wide variety of conditions, with none, one, or more bystanders, including situations in which a person witnesses someone stealing money from another (both with and without a security camera) (van Bommel et al., 2014), graffiti was written on an elevator wall (Chekroun & Brauer, 2002), or a perpetrator is determined to be either dangerous or non-dangerous (Fischer et al., 2011).

Ann Cutting/Getty Images

Diffusion of responsibility **People are less likely to stop and help an apparently lost child if they are part of a large crowd than if they are walking alone on a street. Why? When many others are present, we are not as likely to feel the full burden of responsibility.**

What must occur for bystanders to intervene on someone else's behalf? Researchers believe that several steps are involved (Levine, Philpot, & Kovalenko, 2020; Jouriles et al., 2016; Nickerson et al., 2014; Latané & Darley, 1970). Bystanders must: (1) notice the event; (2) interpret the event as an emergency; (3) feel personal responsibility for acting; (4) consider what form of assistance is needed; and (5) implement action (Brewster & Tucker, 2016; Jenkins & Nickerson, 2016).

Some theorists have focused on the third step, *feeling a sense of personal responsibility*, as the key to bystander apathy (Ashburn-Nardo, Lindsey, Morris, & Goodwin, 2019; Thomas et al., 2016). They suggest that the presence of a large number of people in an emergency situation creates a *diffusion of responsibility* (Freeman et al., 1975), an effect observed in fMRI studies (Hortensius & de Gelder, 2014). When others are present, we feel that we do not bear the full burden of responsibility, and thus we feel less compelled to act. We may also assume that someone else must be taking action (see photo).

Finally, research is starting into issues of bystander reactions to violence within virtual realities, such as cyberbullying over social networks, as well as over shared and online video games and worlds. Early work suggests that similar forces are at work shaping the

behaviours of virtual bystanders as they do for bystanders in the "real" world (Machackova, 2020; Machackova & Pfetsch, 2016).

Researchers Cook (2014) and Lurigio (2015) have reviewed the evidence from the Kitty Genovese murder and both argue that aspects of the case have assumed the stature of an urban legend. They argue there is no evidence that all of the details of the Kitty Genovese murder are accurate. In particular, the researchers argue that there was misinterpretation on several levels. First, there is no evidence that 38 eyewitnesses were ever involved, with only five witnesses admitting to hearing or seeing anything. As well, there is no evidence that one witness saw the entire sequence of events. Indeed, there is no evidence that anyone saw the second attack at all (or a third attack—there were never three attacks) as the final attack occurred in an inside stairwell. As well, there is evidence that the police *were* called and that at least one of the eyewitnesses discouraged the first attack by threatening the assailant from the window of his apartment, chasing the assailant away following the first attack. It has also been suggested that the police may have supported the advancement of the bystander effect argument to cover their own inactions (Kassin, 2017). This is not to argue that the eyewitnesses could not have been more proactive and might have handled things differently and more effectively. This does, however, suggest that some aspects of the story are not supported by the evidence. Why is this important?

Although the bystander body of work is robust and replicable, we continue to view groups as detrimental to social functioning, largely based on this story of the 38 witnesses. There is, however, evidence to suggest that groups can serve a strong prosocial function and facilitate helping (Cronin & Hopper, 2017; Levine & Manning, 2013).

The ubiquity of smart phones today adds another variable to bystander behaviour. Human behaviour is rarely, if ever, clear-cut or black and white. It does not typically conveniently fall into categorical labels. We can try to apply what we have learned in this chapter about stereotypes, racism, and the bystander effect to a Canadian situation, that of the arrest of Chief Allan Adam of the Chipewyan First Nations.

Chief Adam was violently arrested by RCMP on March 10, 2020, outside of a casino in Fort McMurray, Alberta, because of an expired licence plate (Fife, 2020). The full video recording can be found at www.theglobeandmail.com/politics/article-Indigenous-chief-says-rcmp-beat-him-up-and-manhandled-his-wife-over/. In this video, both Chief Adam and his wife can be seen getting assaulted, with no apparent provocation. Chief Adam was pinned to the ground and his head was pounded against the asphalt. Toward the end of the video, bystanders can be seen stopping and taking videos with their devices. Some went to speak with Chief Adam's wife after he had been beaten and removed before she was removed and handcuffed, although they backed away when the numerous RCMP officers moved in line formation toward her, as she was sitting in the vehicle. So bystanders "intervened," but they did not interfere. Why? What does this say about the relations between the people in this video? What does this suggest about the standing First Nations peoples feel they have in our society, or with our law enforcement agencies? Consideration of the cases of Chantel Moore (Meissner, 2020) and Regis Korchinski-Packet (Gillis & Moon, 2020) might add to your reflections.

If you read the articles about Chief Adam, consider also the earlier references in this chapter on media bias as well as the commentary in Thurston & Schill (2015), referred to in

the section on Stereotypes and Prejudice, in particular when considering the perspective presented in the Canadian Press article (2020, June 24) stating the reasons for dropping the charges against Chief Adam. Given what you see in the video, is the presented perspective valid? What impact could this perspective have on public perception of First Nations peoples?

Aggression

In social psychological terms, **aggression** describes a broad category of behaviours, including physical and verbal attacks, intended to do harm to another. Aggression appears to have at least some biological underpinnings. Twin studies indicate that identical twins are more likely to share the trait of violent temper than fraternal twins, suggesting a genetic component (Tremblay, 2015). High levels of the hormone testosterone have been linked with higher levels of aggression, as have low levels of the neurotransmitter serotonin. Indeed, the people most likely to be involved with violent crime are muscular young men with below-average intelligence, high levels of testosterone, and low levels of serotonin (Ellis & Hoskin, 2015; Weierstall et al., 2014).

aggression a broad range of behaviours intended to harm others.

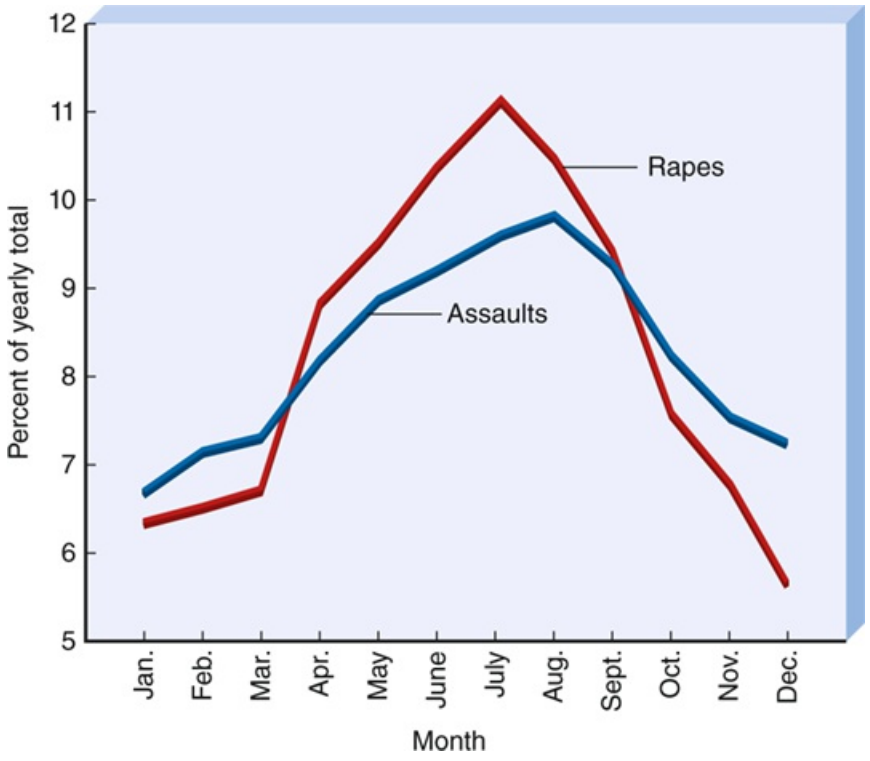

FIGURE 13.11 Aggression by time of year **Studies of data in North America and Europe over the last hundred years show that aggression is highest in the hottest months of the year (Anderson, 1989).**

That said, under the right circumstances, we are all capable of aggressive acts. One major hypothesis explaining aggression in humans—the *frustration-aggression hypothesis*—holds

that we become aggressive in response to frustration (Dollard et al., 1939). Any emotional stressor that impedes our progress or prevents achievement of some goal elicits frustration. Aggression, then, might be a cue to push harder to achieve that goal.

The frustration-aggression hypothesis was later expanded to include the notion that any unpleasant event, ranging from experiencing a bad odour or an annoying sound to hearing bad news, leads to activation of the sympathetic nervous system. As you will see in Chapter 14, activation of the sympathetic nervous system is associated with both anger and fear and with the fight-or-flight response. This theory suggests that if you have translated this activation to aggressive behaviour in the past, and the outcome has had a desired effect, you will continue to engage in that aggressive behaviour (Falkner & Lin, 2014).

Other factors influencing aggression probably result from both biology and environment (**Figure 13.11**). For example, as we have observed previously, men tend to be more aggressive than women—at least in some respects. Women are more likely to engage in acts of *relational aggression*, such as snubbing, gossiping, and otherwise excluding others as a means of venting frustration or anger (Andrews, Martin, & Gallagher, 2016; Ferguson, Zimmer-Gembeck, & Duffy, 2016). (See photo.) However, men are more likely to engage in *direct aggression*, which includes direct physical and verbal abuse. In fact, the vast majority of violent offenders are male (Stephenson, Woodhams, & Cooke, 2014). Because this gender disparity shows up very early in childhood, it may be at least partially attributable to biological gender differences. However, it is probably also affected by social norms within our society, where men are more permitted than women to express anger and act aggressively.

Digital Vision/Getty Images

Relational aggression **On average, women are more likely than men to express their anger with relational aggression (for example, ignoring the person who has angered them).**

Alcohol has also been found to increase aggressive behaviour for both biological and psychological reasons (Crane et al., 2017). The effects of the drug may reduce inhibitions and so make people more likely to engage in violence or verbal abuse. However, people have been shown to become more aggressive even if they only think that they have had alcohol to drink, suggesting that they are responding to social expectations about how

people act when they have been drinking (Berke, Leone, Parrott, & Gallagher, 2020; Johnson, 2014; Ostrowsky, 2014).

Interpersonal Attraction

Why are we attracted to some people and not others? What's the difference between liking someone and loving someone? These are questions central to the study of interpersonal attraction. Interpersonal attraction operates at three levels: *cognitively*, we think certain things about the other person; *affectively*, we experience particular feelings toward the person; and *behaviourally*, we act in certain ways toward the person (Montoya & Horton, 2020; Huston, 2013).

Liking

Liking refers to fondness and affection for another person. Research has revealed five key factors that lead to liking someone.

Similarity—The more similar to us we perceive someone to be, the more likely we are to develop a fondness for that person. In addition, the more similar people are, the likelier it is that their fondness for one another will last a long time (Hampton, Fisher Boyd, & Sprecher, 2020; Kaptein, Nass, & Markopoulos, 2014).

Proximity—We tend to like people whom we encounter frequently more than those we do not encounter often, and we tend to like familiar people more than unfamiliar people (Shin et al., 2019; Sommer & Bernieri, 2015). How many people with whom you have shared two or three classes have become friends?

Self-disclosure—We tend to initially like people who disclose personal information to us, and we tend to disclose more to people whom we initially like, both in person and through social media (Rains, Brunner, & Oman, 2016; Sheldon, 2015).

Situational factors—The situations in which we encounter other people greatly affect how much we like them. It has been suggested, for example, that we like people when we experience rewards while in their presence (Huston, 2013). Furthermore, a shared humorous experience seems to be a powerful way of forging closeness with a stranger (Becker, 2019; Treger, Sprecher, & Erber, 2013). The famous playwright Oscar Wilde once said, "Laughter is not at all a bad beginning for a friendship."

Physical attractiveness—People of all ages, even babies, prefer to look at and be near attractive people. Not surprisingly, then, physical attractiveness may affect likeability (Mitsuhiro & Kitaoka, 2016; Zhao et al., 2015). (See photo.)

Loving

Whereas liking someone involves a sense of fondness, loving is associated with a more extreme affection. When we *love* someone, we experience a strong, passionate attachment to that person. Some see loving as simply an extreme form of liking—with degree of attraction being the key distinction—whereas others see loving as a qualitatively different phenomenon (Berscheid & Regan, 2016).

Sergio Dionisio/Getty Images

New approach, same criteria **Two people meet in a speed dating program at Bondi Beach in Australia. Speed dating is a relatively new form of social engagement in which large numbers of men and women are rotated to meet many potential partners over a series of short three- to eight-minute "dates." What kinds of partners do speed daters choose most often? Those who are attractive and hold attitudes similar to those of the selectors.**

Let's first consider the question of what functions love serves. Freud viewed love as *sublimated sexual energy*—that is, a transformation of sexual desire into a more socially acceptable form (Marcuse, 2015). Evolutionary theorists emphasize love's role in pair-bonding as a means for propagating the species. According to these theorists, strong passionate attachments have ensured that over time, parents would stay together and raise their children together (Fletcher et al., 2015).

Still other theorists argue that love's most important value is to help provide companionship, emotional support, and even protection throughout the lifespan (Bar-Tur, Ifrah, Moore, & Katzman, 2019; Seppala, Rossomando, & Doty, 2013). The positive relational value of pets provides some of these values as well (Hoffmann, Lagerkvist, Gustavsson, & Holst, 2019), particularly for some during COVID-19 lockdowns (Hoy-Gerlach, Rauktis & Newhill, 2020). Loving relationships have in fact been associated with improved health (Robles et al., 2014; Loving & Slatcher, 2013). Such relationships provide us with people to confide in—and not being able to confide our troubles to someone has been associated with a host of health problems (Cornwell & Laumann, 2013). This may be one reason why recently widowed individuals are more vulnerable to disease than individuals of a similar age who have not lost a spouse (Holm, Berland, & Severinsson, 2019; Sorrell, 2012).

What are the building blocks of love? Decades ago, social psychologist Zick Rubin (1970) emphasized three elements of love: attachment, caring, and intimacy. *Attachment* refers to the individual's need or desire for the physical presence and emotional support of the other person; *caring* is a feeling of concern and responsibility for the person; and *intimacy* involves the desire for close, confidential communication with the other individual (Fehr,

2019).

Using this definition of love, Rubin (1973) designed a self-report scale that he hoped would be able to measure love and distinguish it from liking. The scale included *love* items, such as "If I could never be with ____, I would feel miserable" and "I feel I can confide in ____ about virtually everything," along with *like* items, such as "I think that _____ is usually well-adjusted" and "_____ is the sort of person whom I myself would like to be." In one study, Rubin had dating couples fill out this scale, alone and confidentially, focusing on their date partner in their ratings. He found that friends and lovers both scored high on the like items, but friends did not score high on the love items.

In another study, Rubin had volunteer couples come to his laboratory and sit across from each other while awaiting the start of the experiment. His assistants secretly observed the couples from behind a one-way mirror to determine which ones gazed into each other's eyes, a sign of love according to conventional wisdom. As expected, the partners who had scored high on Rubin's love scale gazed lovingly at each other more than did partners who had scored low on the scale.

Another psychologist, Robert Sternberg, previously discussed in Chapter 10, has proposed the **triangular theory of love**, which holds that love is composed of *intimacy*, *passion*, and *commitment* (Sorokowski et al., 2020; Sternberg, 2013, 2004, 1986). Here, *intimacy* refers once again to feelings that promote closeness and connection, *passion* involves intense desires for union with the other person, and *commitment* refers to the decision to maintain the relationship across time. According to Sternberg, the extent and quality of each of these three components determines the nature of a particular loving relationship.

> **triangular theory of love** a theory proposed by Robert Sternberg that love is composed of three elements: intimacy, passion, and commitment.

In fact, Sternberg distinguishes between eight kinds of relationship, each reflecting a particular combination of the three components (**Figure 13.12**). For example, purely *romantic* love consists of much intimacy and passion with little commitment. In contrast, couples who experience *companionate* love are high on intimacy and commitment but low on passion. Couples who experience *consummate* love are high on all three components; and those with *empty* love are high on commitment only. Sternberg also believes these relationships change over time, peaking at different points.

What determines *how* we love? Many theorists suggest that the way we express and experience love is a direct outgrowth of our early experiences with caregivers (Neto, 2020; Hazan & Shaver, 2004, 1994a, 1994b, 1987). For example, as we observed in Chapter 4, young children seem to express one of several kinds of attachment in their relationships with their parents (Ainsworth, 1979). It appears that adults display similar types of attachment in their romantic relationships. Using the attachment model, researchers Cindy Hazan and Phillip Shaver (2004) have proposed three types of lovers.

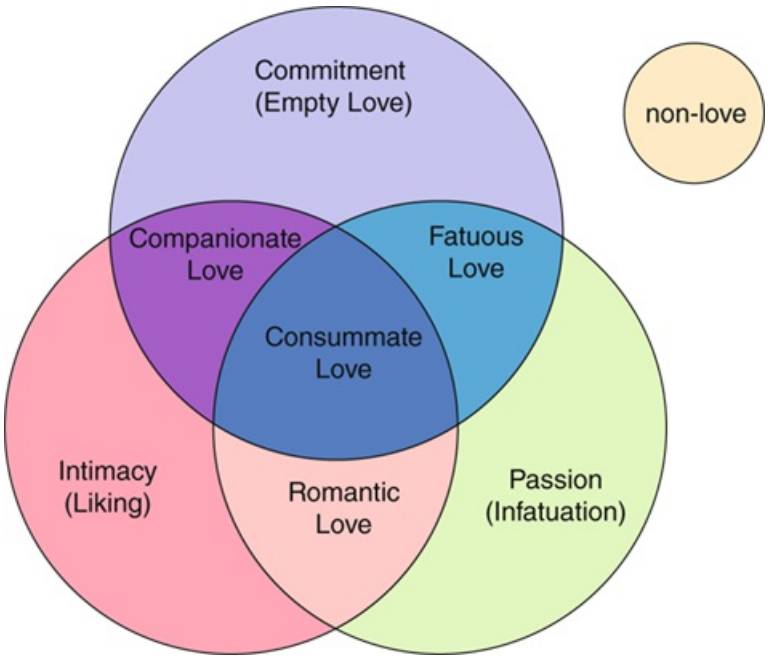

FIGURE 13.12 Sternberg's triangular theory of love **Sternberg's theory (1987) talks about the various possible combinations of intimacy, passion, and commitment and produces eight distinct types of relationship.**

Those with *secure* attachment styles find it relatively easy to become close to others and are comfortable depending on lovers and being depended on. They do not fear becoming too close or being abandoned.

Those with *avoidant* attachment styles are somewhat uncomfortable being close to others and have difficulty trusting others and depending on them. In fact, they become nervous when others want to become closer to them.

Those with *anxious-ambivalent* attachment styles worry that their lovers are less interested in closeness than they are. These insecure individuals are preoccupied with concerns that their partners do not really love them or will not stay with them. Sometimes their demands for security in relationships wind up pushing people away.

In their research, Hazan and Shaver found that approximately 53 percent of adults in romantic relationships display a secure attachment style, 26 percent an avoidant attachment style, and 20 percent an anxious-ambivalent attachment style.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

13. What is groupthink and under what conditions is it most likely to occur?

14. How does altruistic helping behaviour differ from egoistic helping behaviour?

15. How does the presence of other people affect the likelihood that a bystander will

intervene on behalf of someone who needs help?

16. What are some of the biological underpinnings of aggressive behaviour?

17. What are the three components of Robert Sternberg's triangular theory of love and how do they interact in relationships?

What Do You Think? • Think about a relationship you have had with a friend—someone you really like. Analyze the development of that relationship with reference to some of the key factors discussed in this section.

Social Functioning

LEARNING OBJECTIVE 5

Describe the major findings of social neuroscience about regions of the brain particularly important to our social functioning.

Throughout this book, you have seen that with the help of brain-scanning procedures, researchers have tied many areas of psychological functioning, such as memory or emotions, to particular neural circuits—collections of neurons that communicate with each other. The study of social functioning is no different. Indeed, there has been so much work to uncover what happens in the brain when people are thinking and behaving socially that the field of study has been given a special title, *social neuroscience*, and the combination of brain regions that operate together when people function socially has also been given a special name in some circles, the "social brain."

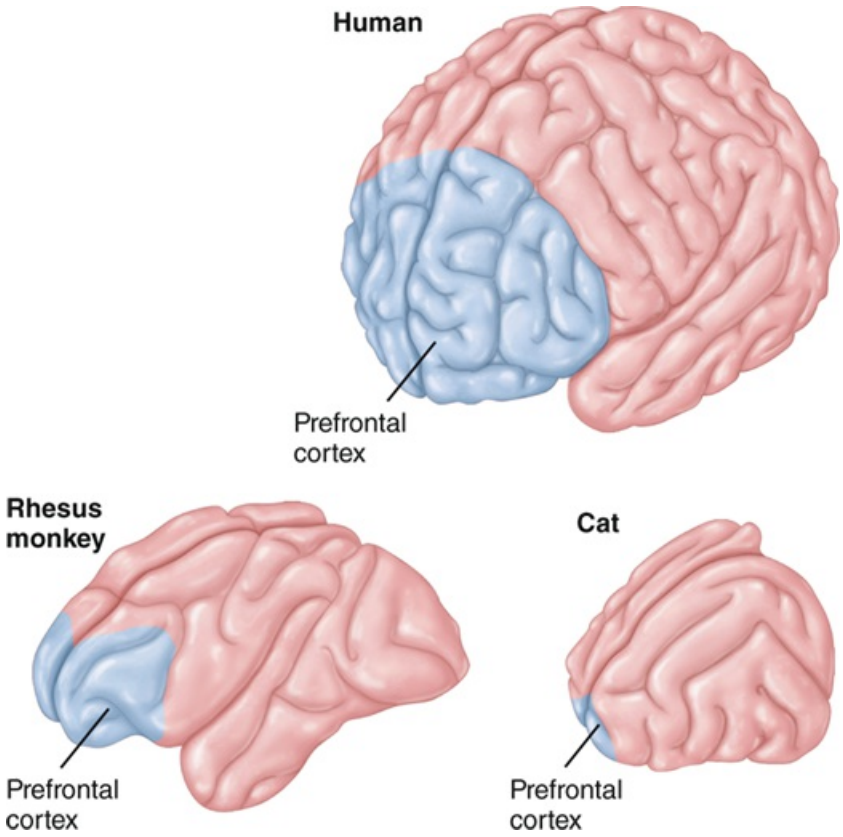

FIGURE 13.13 Across the species The prefrontal cortex of human beings is larger than that of other animals and is, at the same time, very active during social behaviour, suggesting that it plays an important role in human social functioning.

One of the early clues that helped researchers to identify regions of the brain that may be at work in social cognition and behaviour came from evolutionary psychology (De Jaegher, Di Paolo, & Adolphs, 2016; Stanley & Adolphs, 2013). Beginning with the observation that a unique and critically important area of human functioning is social cognition—particularly the ability to infer what is going on (intentions, feelings, and thoughts) inside the minds of other people—scientists decided to pay special attention to those regions that are newer and/or bigger in human brains than in the brains of other animals. Their suspicion was that these regions may be the ones that play key roles in social functioning.

Not surprisingly, several of the brain regions that, according to brain scans, are very active during social cognition and behaviour are indeed particularly large in the human brain. For example, the *prefrontal cortex*, the part of the frontal cortex that is closest to the front of the head, is much larger in humans than in other animals (see **Figure 13.13**). As we observed in Chapter 3, the entire frontal cortex is somewhat larger in the human brain than in the brains of less complex animals. But the prefrontal cortex is particularly larger (Delgado et al., 2016; Kanat, Heinrichs, & Domes, 2014).

Social cognitions and behaviours rely on many of the psychological functions that we have examined throughout this book. They require, for example, rapid identification of social stimuli and signals (for example, recognition of people), rapid retrieval of memories (to help us remember who is a friend and who is a foe), the ability to recognize the perspective

of others, anticipation of others' behaviours, experiences of emotion and empathy, and moral and other evaluations of situations (to help us decide, for example, whether prosocial behaviour is in order). Thus, some of the brain regions that are highly active during social functioning turn out to be ones related to language and thought, memory, and emotion (Fiske & Taylor, 2013). To date, social neuroscientists have identified the following brain regions as among the key players in social functioning:

Orbitofrontal cortex—a subregion of the prefrontal cortex, it is involved in social reasoning, reward evaluation, reading other people, and eliciting emotional states (Apps & Sallet, 2017).

Ventromedial prefrontal cortex—another subregion of the prefrontal cortex, it plays a key role in the processing of rewards and punishments, interpreting non-verbal social information (such as facial expressions), making social and moral assessments and decisions, and feeling empathy (Meyer, 2019; Roy, Shohamy, & Wager, 2012).

Insula—a region of the cortex that is located beneath the frontal cortex, it plays a key role in empathy and in reading others. The insula is activated when we observe others in physical or emotional pain and immediately feel that pain ourselves (Li et al., 2020; Harlé et al., 2012).

Amygdala—a brain region that is located in the temporal lobe, it is, as we have seen, actively involved in the control of emotions. In social functioning, it helps us to identify the emotional facial expressions of other people and to pay particular attention to stimuli that may be unpredictable, potentially rewarding, or potentially punishing (Yao, Xuan, Wu, & Sang, 2020; Becker et al., 2012).

We still have much to learn about how these and other regions operate together to help people function socially. Social neuroscientists are also still trying to identify the precise neural networks that enable us to so readily carry out the social cognitions and behaviours examined throughout this chapter.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

18. What is social neuroscience and what is the "social brain"?

19. Which brain regions have been identified as particularly important to our social functioning?

What Do You Think? • If you were a neuroscientist looking for parts of the brain that are important to social functioning, how would you decide where to look first?

Summary

Social Cognition: Attitudes

LEARNING OBJECTIVE 1 Explain how attitudes form and change and what role they play in behaviour.

Attitudes are relatively stable and enduring evaluations of things and people. According to the ABC model, they have affective, behavioural, and cognitive components.

Parents play a major role in shaping children's attitudes. In older children, peers, teachers, and the media also exert an influence.

Leon Festinger proposed that people change their attitudes when they experience cognitive dissonance—a state of emotional discomfort that arises when a person holds two contradictory beliefs or holds a belief inconsistent with his behaviour.

The self-perception theory of attitude change minimizes the role of emotional discomfort and suggests that people simply infer what their attitudes are by observing their own behaviour.

The attitudes people express are not necessarily related to their behaviour. In part, this is because people sometimes misrepresent their attitudes. They may wish to express socially desirable attitudes, or they may not be aware of what their *implicit attitudes* really are.

Stereotypes and prejudice arise in part from the human tendency to identify with a group. Various explanations of prejudice come from evolutionary theories, realistic conflict theory, and social identity theory.

People use persuasion techniques to try to influence the attitudes of others. The central route to persuasion emphasizes the content of the message, while the peripheral route depends on more superficial appeals, such as the appearance of the spokesperson.

Social Cognition: Attributions

LEARNING OBJECTIVE 2 Discuss how people make attributions to explain their own behaviour and the behaviour of others.

Attributions, or causal explanations of behaviour, can be *dispositional* (internal) or *situational* (external).

People tend to attribute their own behaviour to situational factors and the behaviour of others to dispositional factors. The reliance on dispositional factors to explain others' behaviour is the *fundamental attribution error*.

According to the actor–observer effect, this discrepancy exists because people make situational attributions as actors and dispositional attributions as observers.

People sometimes attribute only their failures to situational factors and attribute their successes to dispositional factors, called the self-serving bias.

Social Forces

LEARNING OBJECTIVE 3 Describe the power of conformity and obedience in shaping people's behaviour.

Society establishes rules, or *norms*, about how people are supposed to act. *Social roles* are sets of norms ascribed to particular social positions. Norms and roles are critical to the smooth functioning of society, but also place limits on individuals.

Conformity is the tendency to yield to real or imagined group pressure. In a famous series of experiments, Solomon Asch found that 75 percent of research participants yielded to implicit group pressure to conform to an incorrect judgment.

Unlike conformity, obedience involves following direct orders, usually from an authority figure. Experiments by Stanley Milgram found that 65 percent of subjects continued to follow orders to administer what they believed to be dangerous electric shocks.

Social Relations

LEARNING OBJECTIVE 4 Review major concepts in the areas of group dynamics, helping behaviour, aggression, and interpersonal attraction.

The *social facilitation* effect occurs when the presence of others enhances a person's performance. Research shows that this effect holds for simple, well-learned tasks; but the presence of others can impair performance on more complicated tasks.

With social loafing, people in a group exert less effort on a task than they would if performing the task alone.

Group polarization is a phenomenon in which group discussion intensifies the already-held opinions of group members and produces a shift toward a more extreme position.

Groups with certain characteristics—a strong similarity among members, high group cohesiveness, high perceived threat, elevated stress, insulation from outside influence, and a directive leader—may become victims of groupthink, a faulty decision-making process in which group members strive for unanimity at the expense of realistically appraising alternative courses of action.

Helping behaviour is of two types: altruism, which is motivated by concern for others, and egoistic helping behaviour, which is motivated by a desire to reduce one's own distress or receive rewards.

People are more likely to engage in helping behaviour when alone than when in the presence of others. Theorists propose that the presence of others may create a diffusion of responsibility, in which no single individual feels personal responsibility for acting.

Aggression describes a broad range of behaviours intended to do harm to another. Aggression has some biological underpinnings. In addition, the frustration-aggression hypothesis proposes that aggression arises in response to frustration.

Factors that lead to liking another person include similarity, proximity, self-disclosure, situational, and physical attractiveness.

One description of love includes three elements: attachment, caring, and intimacy. Another, Sternberg's triangular theory of love, holds that love is composed of intimacy, passion, and commitment, which combine in varying degrees.

Similar to young children, adults display three types of attachment in love relationships: secure attachment, avoidant attachment, and anxious-ambivalent attachment.

Social Functioning

LEARNING OBJECTIVE 5 Describe the major findings of social neuroscience about regions of the brain particularly important to our social functioning.

Social neuroscience is the specialty of neuroscience that studies how the brain works during social functioning. Social functioning is so important and uniquely human that social neuroscientists have given the name "social brain" to the combination of brain areas that are particularly active in social functioning.

The orbitofrontal cortex, ventromedial prefrontal cortex, insula, and amygdala all have been identified as especially important in social functioning. Researchers continue to try to pinpoint neural connections related to social functioning.

Key Terms

ABC model of attitudes

actor–observer effect

aggression

altruism

attitudes

attributions

cognitive dissonance

conformity

fundamental attribution error

group

group polarization

groupthink

implicit attitude

norms

obedience

prejudice

self-perception theory

self-serving bias

social cognition

social facilitation

social identity theory

social loafing

social psychology

social role

stereotypes

triangular theory of love

Self-Study Questions

Multiple Choice

1. A woman who is participating in a march to draw attention to an issue that is important to her is demonstrating the _____ component of attitudes.

- **a.** affective
- **b.** behavioural
- **c.** cognitive
- **d.** perceptual

2. We are most likely to persuade someone to help us with a time-consuming, unappealing task if we

- **a.** ask the person to help with a smaller task first.
- **b.** begin with a weak argument, then follow up with a strong one.
- **c.** forewarn the person that a request is coming.
- **d.** make sure the person is in a bad mood.

3. The fundamental attribution error occurs when we overestimate _____ when thinking about the causes of other people's behaviour.

- **a.** dispositions
- **b.** extenuating circumstances
- **c.** situations
- **d.** temporary factors

4. A(n) _____ norm is one that is not taught directly, but that people tend to pick up on.

- **a.** descriptive
- **b.** explicit
- **c.** implicit
- **d.** injunctive

5. In Asch's original study of conformity, about what percentage of participants conformed

(gave a response that they knew was incorrect) at least once?

a. 1 percent

b. 37 percent

c. 66 percent

d. 75 percent

6. Group members who are each mowing the grass on their assigned section of a golf course are engaging in a(n) _____ task.

a. additive

b. conjunctive

c. disjunctive

d. divisible

7. The Kitty Genovese murder and subsequent research helped psychologists understand that when people fail to help others, it is usually because they

a. are apathetic and unconcerned with other people's well-being.

b. fail to see the benefits of helping others.

c. get caught up in a powerful social situation.

d. have valid reasons for failing to help.

8. According to Sternberg, a high degree of intimacy, passion, and commitment is characteristic of _____ love.

a. consummate

b. fatuous

c. infatuated

d. romantic

9. The part of the brain that is most directly related to our experience of both empathy and the ability to read others is the

a. amygdala.

b. hypothalamus.

c. insula.

d. orbitofrontal cortex.

10. An Olympic coach is training an athlete and wants to see the athlete's time improve. You tell the coach that according to the _____ effect, he would be better off to get actual people to run against the athlete in training.

a. groupthink

b. social facilitation

c. group polarization

d. social loafing

Fill-in-the-Blank

1. Festinger's research showed that behaviour leads to attitude change only when there is no other good reason, or _____, for the behaviour.

2. Attitudes are more likely to predict behaviour when the attitudes are high in strength and/or _____.

3. If a teacher assumes that a student is always late for class because the student is lazy and unorganized, the teacher is making a(n) _____ attribution for the student's behaviour.

4. In a study of cultural influences on attributions, it was found that the characteristic of _____ led Chinese participants to focus on situational causes of behaviour more than American participants did.

5. Groups with fewer than _____ members do not typically show a conformity effect.

6. Milgram told his research subjects that they were participating in a study of the effects of _____ on learning.

7. Zajonc proposed that the presence of others increases our physiological _____, which then improves or impairs task performance depending on the task and the person.

8. When others are present, we may feel that we do not bear the burden of responsibility to act. This phenomenon is known as diffusion of _____.

9. Neuroscientists have found that the _____ cortex is important to social functioning and is larger in humans than in other species.

10. Those with _____ attachment styles find it relatively easy to become close to others and are comfortable depending on lovers and being depended on.

CHAPTER 14
Stress, Coping, and Health

andresrimaging/iStockphoto.com

CHAPTER OUTLINE

What Is Stress?

LEARNING OBJECTIVE 1 Define stress, describe the ways in which people experience stress and the kinds of situations that typically cause stress.

Responding to Stress

LEARNING OBJECTIVE 2 Describe the physiological, emotional, and cognitive responses to stress, and explain how individual responses to stress differ.

Coping with Stress

LEARNING OBJECTIVE 3 Discuss and evaluate several ways in which people cope with stress.

Stress and Health

LEARNING OBJECTIVE 4 Explain how stress can cause physical illness, and discuss situations in which stress may be beneficial.

Posttraumatic Stress Disorder

LEARNING OBJECTIVE 5 Describe the symptoms and causes of posttraumatic stress disorder, and discuss some risk factors for developing it.

"What am I doing?" thought Ashley as she sat at her desk, unable to concentrate. "My English paper is due on Wednesday, but I'm just staring at a blank computer screen. I know I need to get started, but I can't concentrate on this paper." All sorts of thoughts are flying through Ashley's head—each one makes her chest tighten and makes her want to curl up into a ball with her eyes shut.

She has to leave for her job in less than an hour. She desperately needs the bus to be on time. Chris, her boss, has told her that if she is late again, he'll "have to find someone more reliable." And then there is the email she just got from her parents asking—once again—about her grades. She is the first child in her family to go to university, and her parents have been driving her crazy. She's glad that they are so excited, but don't they realize that asking for weekly updates only puts more pressure on her?

In fact, things aren't going so well in some of her classes. She's good at chemistry, but she finds English, especially writing, very difficult. "Just work harder," her parents tell her, as if she wasn't trying as hard as she could. Her public speaking class is a disaster: she actually had to leave in the middle of her last speech, fighting back tears.

The more trouble she has, the more she feels like just going out with her friends at night. In fact, she's gone out every night this week, always telling herself, "I'll get started on my paper tomorrow." Even though she knows she can't put her paper off any longer, she has agreed to see a movie tonight after work with some people from school.

Then there is the recent breakup with her boyfriend, Jason. She feels bad about the way their relationship ended. One night when she was late for work and in a panic, he called her and teasingly refused to let her off the phone. After a few minutes, she called him a jerk and hung up on him. It wasn't the first time she had lashed out at him, and even though she tried to apologize the next day, he said he didn't want to deal with her moods anymore.

"All right, let's try to get it together," she tells herself. "Come up with a game plan." She decides to jog to the restaurant, avoiding bus delays and getting some exercise to boot. Moreover, in the few minutes she has before she must leave for work, she forces herself to start typing. Before too long, she has two paragraphs on the screen. "Not bad," she thinks, "at least it's a start." She is finally thinking and acting constructively.

You don't need a textbook to tell you that Ashley is experiencing stress. After all, you may have been, or are, in a similar place—too much to do, too little time, too many expectations, too little certainty about what to do next. Ashley is obviously feeling stress because she has lots of work to do and is running out of time. But she also has feelings of stress connected to something otherwise pleasant—the opportunity to socialize with friends. Things as common as writing an English paper, as pleasant as the prospect of an evening out, or as awful as a life-threatening medical condition can prompt feelings of stress.

Stress affects us both physically and psychologically (see photo). Recall how you felt the last time you were stuck in a traffic jam on your way to someplace important. Chances are you had physical and psychological reactions—you may have been frustrated and angry, your stomach may have been tied up in knots, and you may even have pounded on the steering wheel or yelled. Chronic stress from our modern world can even damage our health.

The effects of stress on psychological and physical health have made it a subject of major research. Some researchers are trying to clarify what makes situations stressful. Others are studying how stress affects the body. Still others are trying to figure out what responses help people to cope effectively with stress and lessen its toll. This chapter examines what researchers have learned about the sources and effects of stress. It also looks at ways to deal with stress, noting that certain kinds of behaviour—such as Ashley's jog to work or her

decision to simply start writing her paper—can help people reduce stress or cope with it positively.

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What Is Stress?

LEARNING OBJECTIVE 1

Define stress, describe the ways in which people experience stress and the kinds of situations that typically cause stress.

You probably use the word *stress* all the time. We talk about being stressed, feeling stress, or about stressful events and situations, but have you thought about what it actually means? The term has been defined in various ways, so we will begin our examination of stress with a definition. We will then discuss the ways in which people experience stress and the kinds of situations that cause stress.

Stress and Stressors

Stress is a state brought on by any situation that threatens or appears to threaten a person's sense of well-being, thus challenging the person's ability to cope. A situation or circumstance that triggers the stress response is called a **stressor**. Stressors can be *acute* or *chronic*. An **acute stressor** is short term and has a definite endpoint—for example, a near miss in heavy traffic. A **chronic stressor** is long term and often lacks a definite endpoint—for example, dealing with a high-pressure job (see photo) or being unemployed over time.

stress state brought on by any situation that threatens or appears to threaten a person's sense of well-being, thus challenging the individual's ability to cope.

stressor a situation or circumstance that triggers the stress response.

acute stressor a stressful situation or circumstance that happens in the short term and has a definite endpoint.

chronic stressor a stressful situation or circumstance that is more long term and often lacks a definite endpoint.

Brendan McDermid/Reuters - Images

Anxious moments A trader on the floor of the stock exchange watches the numbers on the board anxiously, waiting desperately for a favourable moment to make his move.

Obviously, our definition of stress is rather broad—literally anything can cause stress. The breadth of the definition takes into account the wide range of situations that people experience as stressful, from daily pressures at work and school to more catastrophic events, such as health crises, natural disasters, and terrorist attacks. At the same time, the definition calls attention to the emotional experience of stress and how individualized stress is.

A number of psychological factors help to determine the degree to which something will cause us to experience stress. In fact, stress is actually derived more from how we *appraise* the situation than from the situation itself (Folkman, 2013a, 2013b; Lazarus & Folkman, 1984). That is, our appraisal of our ability (or inability) to cope with a situation is an important factor in how much stress we experience. For example, two people attending a party of mostly strangers may approach the party with differing levels of stress. One person may view the situation as exciting, enjoying the idea of meeting a lot of new people. Another person might instead view the same situation as highly stressful, feeling very threatened by the idea of meeting a large number of new people. In each instance, each

person appraises the situation based on their perceived ability to cope. It is therefore our *perception* of threat that triggers the emotional state we connect to stress. If we do not perceive a situation as threatening, we will not feel particularly stressed. We will soon look at more psychological factors in stress, but before that, let's examine the different ways that people experience stress.

Ways of Experiencing Stress

By definition, people who experience stress feel threatened and challenged. But these threats and challenges come in different forms. Certainly, soldiers in combat, students whose grades are falling, and children whose parents are unhappy with them face different kinds of stress. Individuals who experience stress often have one of four kinds of experiences that lead to feeling stressed. These are: *frustration*, *pressure*, *conflict*, and *danger*. These kinds of stress are not mutually exclusive even though we consider them separately here. As you read through the next few sections, think about how these various aspects of the stress experience might go together.

Feeling Frustrated

You finally find a parking spot, and someone pulls into it just ahead of you. You try to register for a course, and it is full. You work hard, but you get a C on the test. Whenever we find ourselves thwarted in the pursuit of a goal, we experience **frustration**. Life is full of frustration; it is one of our most familiar kinds of stress. Frustration can be caused by acute stressors, such as those in the situations just described, and by chronic stressors. Persons who have chronic illnesses or disabilities, for example, are likely to feel frustrated that they cannot do more. All of these experiences are bound up with the notion of trying to achieve something and having a barrier to our progress (Beehr, 2014). Barriers to progress generate stress.

frustration an emotion people experience when thwarted in pursuit of a goal.

Feeling Pressured

We all encounter a certain amount of **pressure**—the expectation that we should act in a certain way. The pride felt by Ashley's parents over their daughter's admission to university is a source of pressure, and her boss's expectation that she should arrive at work on time is another.

pressure an expectation or demand that someone act in a certain way.

Pressure often comes from within. Some individuals have such high expectations of themselves that they are constantly under self-imposed stress. Think of the sources of pressure in your own life. What standards do you set for yourself academically and socially? Are you driven to achieve in athletics, music, or *Call of Duty*? How much pressure do you experience as a result of such expectations? For some, stress that comes from within is often more difficult to cope with than stress imposed by others. It may not be easy to meet the deadline for turning in a term paper, but at least when you do so, the pressure will

be off. By contrast, if you set yourself a rigid standard of perfection, you may never find release from this internal pressure.

QMI Agency

A costly error **A dejected Steve Smith immediately after scoring on his own goal, an error that led to the Edmonton Oilers losing the Stanley Cup Western Conference semi-final game back in 1986.**

Pressure also varies along with the task and situation. One set of studies, for example, demonstrated that participants experienced greater stress when performing complex tasks in front of an audience, but that they performed significantly better without the pressure of an audience (Oudejans et al., 2017). Focusing on the specific task they are performing can also reduce perceptions of stress (Buma, Bakker, & Oudejans, 2014). Still other research has found a strong correlation between feelings of pressure and symptoms of distress, indicating that perceived discrimination is associated with increased levels of depression and an increased number of medical diagnoses (Todorova et al., 2010).

Sports and Pressure

In the 1986 Western conference semi-finals between the Edmonton Oilers and the Calgary Flames, Oiler Steve Smith made a heartbreaking mistake. The game was tied 2–2 in the third period of the seventh and deciding game, and Smith was carrying the puck out from behind his own net with no one checking him. He attempted a cross-ice clearing pass that somehow bounced off the back of his own goaltender (Grant Fuhr) and ended up in his own team's net. Calgary knocked the two-time Stanley Cup-winning Oilers out of the playoffs. Smith was devastated. It also happened to be his birthday, and he has since said that now he thinks of the goal every time he blows out his birthday candles (see photo).

What happened to Smith and to other athletes who have made mental errors in other high-pressure situations? When does pressure help athletic performance and when does it impair it? These questions have been the subject of much study. A number of explanations

have been offered, but a clear understanding of the effects of pressure on athletes remains elusive (Weinberg & Gould, 2015).

We do know that performance pressure results when athletes feel strongly about the outcome of an event and believe that their own performance will have an impact on that outcome (Bali, 2015). We also know that this pressure can result in increased physiological and psychological arousal. But researchers cannot predict the precise relationship between such arousal and performance.

For years, psychologists believed that the relationship probably follows the principle of the *Yerkes-Dodson law*. As we discussed in Chapter 11, this psychological "law," developed in 1908 by psychologists Robert Yerkes and John Dodson, holds that performances on tasks of any kind increase along with physical or mental arousal—up to a point—but once an optimal, moderate level of arousal is passed, performances begin to decrease. Applying this law to athletic performances, it is generally believed that if an athlete is not aroused, his or her performance will suffer, and that if he or she is too aroused, performance will also suffer. Optimal performance is thought to occur only in the presence of a moderate level of arousal (Yerkes & Dodson, 1908).

Over the years, research has better supported an alternative version of the Yerkes-Dodson law, particularly in the realm of athletic performance. Recall from Chapter 11 that this alternative model holds that the level of arousal at which optimal performance occurs is a *zone* (not a single point) and varies from athlete to athlete. Some cross-country runners, for example, will perform best if they take naps right before a race, while their teammates will do best if they listen to inspiring music, visualize their opponents, and engage in intense stretching exercises before the race (Bali, 2015; Rathschlag & Memmert, 2015).

A different line of research suggests that coaches can play a large role in helping athletes cope with performance pressure. Since anxiety tends to be lowest in athletes who believe in their performance abilities and are self-assured, research suggests that coaches can help by facilitating feelings of confidence—for example, by providing frequent, genuine encouragement and by fostering a positive environment, regardless of whether things have gone well or mistakes have occurred (Beaumont, Maynard, & Butt, 2015; Pineschi & Di Pietro, 2013). Here again, however, effective methods vary from athlete to athlete.

Feeling Conflicted

The stress Ashley feels is not simply the result of pressure from her parents. It also results in part from her desire to do two things at the same time: (1) study to earn good grades, and (2) have time to go out with her friends. In situations such as this, we experience **conflict**—discomfort brought about by two or more goals or impulses that we perceive to be incompatible. There are three basic types of conflict: *approach–approach*, *avoidance–avoidance*, and *approach–avoidance* (see **Figure 14.1**) (Miller, 1959; Lewin, 1935).

conflict discomfort brought about by two or more goals or impulses perceived to be incompatible.

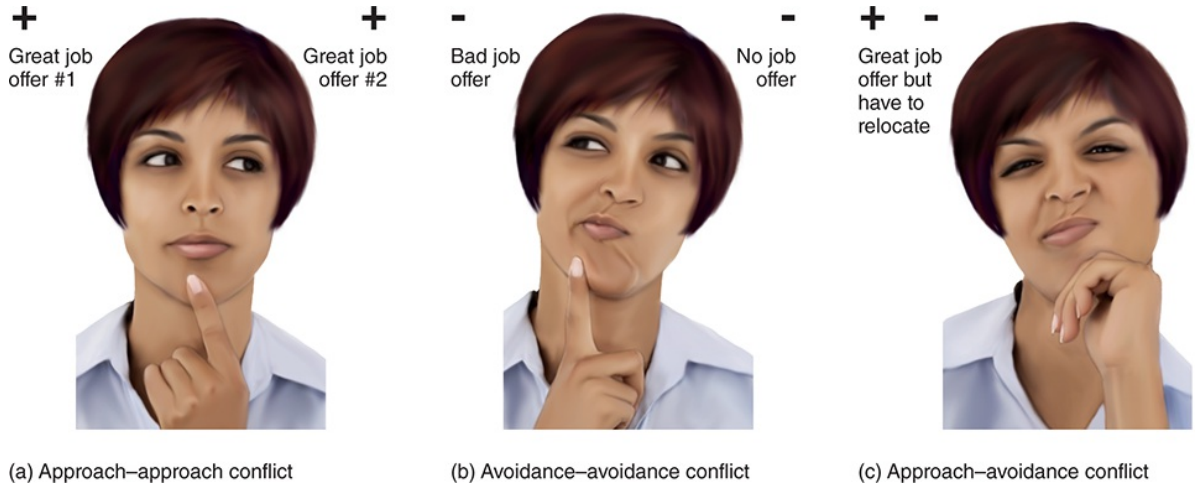


FIGURE 14.1 Three basic types of conflict that can lead to stress

As its name implies, **approach–approach conflict** occurs when we must choose between two equally desirable options. Should we have the chocolate cake or the blueberry pie? Should we buy the red backpack or the black one? In many cases, approach–approach conflicts are easy to resolve (you can't really lose with either choice), and so they are not especially stressful.

Avoidance–avoidance conflicts are somewhat more stressful because here the choice is between two equally undesirable outcomes. Should you clean the garage or do the laundry? You may be tempted to do neither. If you deal with this kind of conflict by deciding to procrastinate, postpone, or avoid the choice, however, you are particularly likely to experience stress (Sirois & Kitner, 2015).

In an **approach–avoidance conflict**, any available choice has both desirable and undesirable qualities, rendering us ambivalent and indecisive. In some situations, this sort of conflict may involve only one choice with both positive and negative features. For example, if Ashley were to go out with her friends, she would enjoy herself, but she wouldn't be able to work on her paper. In other situations, more than one option may be involved. Should you buy a car that is expensive but fuel-efficient, for example, or a less expensive gas guzzler? Approach–avoidance conflicts are on display in many of our most agonizing decisions. Often people worry for some time about how to resolve them, and experience considerable stress along the way.

approach–approach conflict conflict that occurs when a person must choose between two equally desirable options.

avoidance–avoidance conflict conflict that occurs when a person must choose between two equally undesirable options.

approach–avoidance conflict conflict that occurs when any available choice has both desirable and undesirable qualities.

Feeling Endangered

Life-threatening situations understandably produce stress, making us feel endangered. The

adrenaline rush we experience when a car in front of us suddenly stops, forcing us to swerve and slam on the brakes, is characteristic of this kind of stress. Similarly, such stress is experienced by people who face combat or are trapped in a fire. Natural disasters and pandemics, such as the outbreak of COVID-19 in 2020, may also be life threatening and, in turn, stressful (see Psychology Around Us 14.1). Life-threatening situations created by people may also produce stress. Terrorism leaves individuals with feelings of uncertainty, sadness, and fear, making them vulnerable to the onset of stress disorders (Tracy et al., 2014; Zemishlany, 2017). Indeed, terrorism may have long-term psychological effects (see photo).

Carmen Taylor/AP Images

Stress and terror **The aftermath of life-threatening events, like the terrorist attacks of 9/11, might lead some New Yorkers to experience a sense of intense fear at the sight of a plane in the sky, or to cringe at the sound of a bus backfiring.**

Kinds of Stressors

Just as there are different ways of experiencing stress, there are different types of stressors. Indeed, stressors vary widely—from discrete life events to chronic stressors. Moreover, they can be mild, extreme, or anywhere in between. As you will see later in this chapter, what is stressful for one person may not be stressful for another. Still, there are several kinds of events that are likely to produce feelings of stress whenever they are experienced: daily hassles, such as traffic jams; life changes, such as the loss of a job; traumatic events, such as natural disasters; chronic negative situations, such as an enduring illness; and special socio-cultural conditions, such as racism. We will discuss each of these categories in turn, but as you know all too well, they may overlap or intersect.

14.1 Psychology Around Us

The COVID-19 Pandemic and Stress

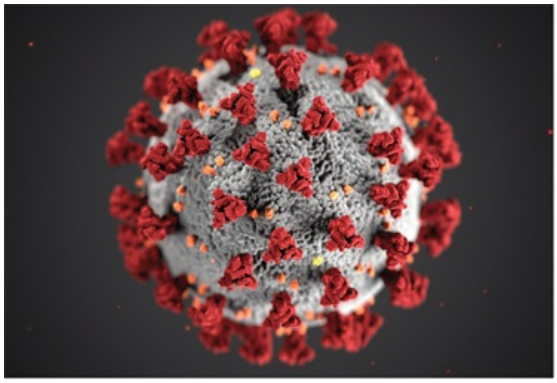
The global COVID-19 pandemic that began in 2020 introduced stressors into our society that hadn't been seen since the 1918 Spanish Flu pandemic more than 100 years ago. There was worry about the risk of catching COVID-19 and falling ill but that was just part of its stressful effects. The risk of unknowingly passing on the disease to a

vulnerable family member was also a significant stressor. Beyond those obvious stressors, families had to isolate, stay inside, and work from home. This put stress on close family relationships as many people were required to be in close proximity to each other for weeks or months on end. For health care workers on the front lines of the pandemic, their stresses were magnified as they worked in higher risk situations and then had to return home to their families after their shift (Carroll et al., 2020; Horesh & Brown, 2020; Pakpour, Griffiths, & Lin, 2020; Wu, Styra, & Gold, 2020).

Fortunately, the stressors of the isolation induced by the COVID-19 pandemic were offset somewhat by the Internet. While not the same as face-to-face contact, people were at least able to communicate with friends and loved ones on a regular basis via texting, video calls, and various meeting room software. For the elderly population, access to the Internet reduced stress (Nimrod, 2020), which was a small silver lining in an otherwise stressful crisis situation.

Seeking the support of others, whether in the form of professional assistance or just a sympathetic ear, was another way to ease the effects of stress of the pandemic. The knowledge that family and friends were available for social support eased the effects of stress in a couple of ways: by reducing the actual number and impact of stress-inducing situations, and by providing practical, problem-focused assistance when stressors arose.

In times of stress, self-disclosure, which is the sharing of emotions and experiences with others, can also help people deal with stress. “Getting something off your chest” with a friend is more than the simple venting of emotional baggage—it actually helps people to channel emotions into a cohesive narrative, thereby making stressors easier to deal with. The key to self-disclosure is ensuring that you have an attentive listener who is willing to help you when you need to unload your feelings around a stressor. While finding a listener in person during a pandemic may be challenging, social media can be a virtual space where self-disclosure about the stress of things such as COVID-19 can be mitigated (Zhang, 2017).



CDC/Unsplash.com

Bloomberg/Getty Images

Fox7

The COVID-19 pandemic created stress for many people worldwide Reaching out to friends and family, either in person or via online communication, are two strategies that can be used to mitigate the stress that is associated with the COVID-19 pandemic. Here we see people taking advantage of the stress relief that nature can bring by spending time outdoors either exercising or sitting within social distancing circles in a park.

Daily Hassles

Probably the most familiar sources of stress are **daily hassles** (also called micro-stressors)—the everyday annoyances that leave us feeling upset and at the end of our rope. These stressors can range from minor irritations, such as lost keys or an overly talkative co-worker, to major problems, such as intense work pressure or conflict with a romantic partner. Some daily hassles seem to be universally upsetting, including time pressures, cash-flow problems, feelings of being cheated after making a purchase, conflicts with romantic partners, mistreatment by friends, and poor evaluations at work.

> **daily hassles** everyday annoyances that contribute to higher stress levels; also known as *micro-stressors*.

Over time, daily hassles can add up. They may become particularly stressful when they occur in combination with other stressors, leaving individuals overwhelmed (Falconier et al., 2014; Schönfeld et al., 2016). A hot day may not be particularly stressful by itself, but combine it with waiting in a long line to renew a driver's licence, holding a crying child, and

having a blister on your heel, and you may wind up feeling exasperated and depleted. In fact, data suggest that the accumulation of daily stressors often leads to increased health risks (Piazza et al., 2013; Wirtz & von Känel, 2017). Meanwhile, research has found that engaging in healthy living habits decreases the impact of university or college stress among students (Fogel & Pettijohn, 2013).

It turns out that the impact of daily hassles on health is often greater than that of a major life event. This is because ongoing stress may impair our immune system responses, as we shall see later. Indeed, one study found that people who face daily commutes in heavy traffic are particularly likely to miss work because of colds and flu (Koslowsky, Kluger, & Reich, 2013)—illnesses that can result from stress-induced changes in the immune system.

Researchers have developed several measures of daily hassles. Psychologist Richard Lazarus and his colleagues developed one of the first, the *Daily Hassles Scale*, in which subjects are asked to consider a list of hassles, indicate which ones they had experienced over the past month, and report how stressful each event felt (Kanner et al., 1981). Measuring the impact of daily hassles is difficult, because people vary widely in how they experience and weigh such stressors (Kohn, 1996 ; Graf, Ramsey, Patrick, & Gentzler, 2016).

Some scales have targeted the experiences of college and university students and asked about both daily hassles and major stressful events (D'Angelo & Wierzbicki, 2003; Kohn, Lafreniere, & Gurevitch, 1990; Vogel & Schwabe, 2016). Feelings of stress tend to be strongest just before an exam and continue (though to a lesser extent) as students wait to receive their grades and as they later try to cope with the results (Strack & Esteves, 2015; Sweeny & Howell, 2017; Zwettler et al., 2018). (See photo.) See **Table 14.1** to review items on the Undergraduate Stress Questionnaire (Crandall, Preisler, & Aussprung, 1992).

TABLE 14.1

Undergraduate Stress Questionnaire

Source: Undergraduate Stress Questionnaire. Crandall, C. S., Preisler, J. J., & Aussprung, J. (1992). Measuring Life Event Stress in the Lives of College Students: The Undergraduate Stress Questionnaire (USQ). *Journal of Behavioral Medicine, 15*(6), 627–662.

Has this stressful event happened to you at any time during the last 2 weeks? If it has, please check the space next to it. If it has not, please leave the space blank.	
Lack of money	No sex for a while
Someone broke a promise	Someone cut ahead of you in line
Death (family member or friend)	Broke up with boyfriend/girlfriend
Dealt with incompetence at the registrar's office	Tried to decide on major
Couldn't concentrate	Felt isolated
Had a lot of tests	Had roommate conflicts
Thought about unfinished work	Chequebook didn't balance
Someone did a "pet peeve" of yours	Visit from a relative and entertained them

It was finals week	Someone you expected to call did not
Had an interview	Holiday
Had projects, research papers due	Sat through a boring class
Did badly on a test	Favourite sporting team lost
Couldn't finish everything you need to do	Thought about the future
Heard bad news	

These are a few of the items from this measure. If you would like to see and/or complete the whole measure, you can download it here: https://utulsa.edu/wp-content/uploads/2014/12/Undergraduate-Stress-Questionnaire.pdf (via Undergraduate Stress Questionnaire Link).

If you are concerned about how many stressful life events you have checked, you can contact your college or university counselling or wellness centre or check out some stress management resources on Health Canada's website: www.canada.ca/en/public-health/services/chronic-diseases/mental-illness/deal-most-effectively-stress.html

14.1 Indigenous Experiences

Life Changes

Robert Tomah was 9 years old in June 1966 when his father died. By early September, he was taken to the Lejac Residential School in the Fraser Lake area of British Columbia. Before entering the school, Robert spoke only Sikanni, lived a nomadic lifestyle with his immediate and extended family, and had never lived outside of the bush, trapping and travelling the waterways in riverboats. He and his brother were sent by plane to the school, away from their mother and most of their relatives. He said that "right away everything looked different to us." He had never seen a car or a street. He said that on the surface, the new life was glamorous but that even as a child he knew that "something hideous [was] hidden under all that glamour." He was initially trusting of everyone. He loved and trusted his parents and assumed that all adults were like them. He was quickly disabused of this assumption. Within hours of his arrival at the school he was cuffed, slapped, and struck for not understanding what was being said to him in English, which he did not speak or understand. Robert and his brother were told by cousins at the school that they had to stop speaking the Sikanni language because the priests and nuns felt that their language was "satanic." Robert and his brother had their heads shaved and their "bush clothes" taken away. They went to bed hungry every night. Eventually Robert was sexually abused by one of the nuns at the school. He recollects, "something happened to me. My trust was gone." He was frustrated and scared. "There was a lot of anxiety." He learned to lie and to blame others. "I began to deny myself… That first year was really hard because I couldn't communicate, and I couldn't understand." (Legacy of Hope Foundation, 2020)

Handout/Reuters

Hair as a source of power and strength **Children were considered "dirty savages" by many of those working in the residential schools. As a consequence, most children were given a haircut immediately upon arrival. Their hair, which, for many, carried important spiritual significance, was thrown into the garbage, and was kept short for the duration of their stay.**

Critical Thinking Questions

Life changes are a common source of stress. What life changes did Robert Tomah experience within a year that would have made him especially susceptible to stress?

What physiological responses to stress do you feel Robert would have likely suffered in that first year at the residential school?

Given the relationship between stress and illness, what would you predict might be some of the outcomes Robert experienced as an adult? Check to see whether you were correct at https://legacyofhope.ca/en/wherearethechildren/stories/tomah/.

Change

Another common source of stress is change. Those early weeks in a new school, for example, are usually quite stressful, even if they are also exciting. In the first weeks of college or university, students need to figure out what classes to take, where classrooms are located, what is expected of them, and where to buy books (as well as how to pay for them). At the same time, they are meeting many new people. Trying to find our way in new relationships can be even more complicated and challenging than finding our way to class (Gale & Parker, 2014).

damircudic/iStockphoto.com

Feeling stressed **The first set of midterm exams for first-year post-secondary students are often quite stressful.**

Life changes—shifts in life circumstances that require adjustment of some kind—were among the first sources of stress ever studied. In 1967, investigators Thomas Holmes and Richard Rahe set out to develop a way to systematically measure how much stress people experience. They compiled a list of 43 events that were likely to change a person's life and therefore cause stress. These events ranged from the death of a spouse, to minor violations of the law, to taking a vacation (note the similarity of these items to those on the Undergraduate Stress Scale, which was adapted from the Holmes Rahe scale). Based on ratings by participants, the researchers assigned a point value to each event, ranging from 1 to 100 points, or *life-change units (LCUs)*. The point value for each event corresponded to the amount of upset and adjustment the event typically produced. The death of a spouse received a score of 100 LCUs on the scale, for example, whereas a change in responsibilities at work was 29 LCUs, and taking a vacation came in at 13 LCUs.

life changes shifts in life circumstances that require adjustment of some kind.

With this 43-item list, called the *Social Readjustment Rating Scale (SRRS)*, Holmes and Rahe set about conducting studies on the impact of stress on people's lives. First they had individuals complete the scale to determine how much stress they were under. Participants were asked to check off all those events that had occurred in their lives over a certain time period, usually the past year. Then they added up the total number of life-change units, with the sum indicating the amount of stress the person had been under. A total score of 150 LCUs or less indicated relatively little stress; 150 to 199 indicated mild stress; 200 to 299 suggested moderate stress; and over 300 LCUs pointed to major life stress. Holmes and Rahe claim that those individuals who score over 300 are more likely to experience physical illness than those who score below 150 points. The life events from the SRRS and their ratings are listed in **Table 14.2**. Notice that a life-changing event need not be an undesirable one. A number of the events on the SRRS are positive, and some can be either

positive or negative. A change in living conditions, for example, may reflect a move upward or downward in life.

TABLE 14.2

The Social Readjustment Rating Scale

Source: Reprinted from Holmes & Rahe (1967). The Social Readjustment Rating Scale. *Journal of Psychosomatic Research*, Vol. III, 213–218. With permission from Elsevier.

To score your susceptibility to stress on this scale, add up the life change units for the events you experienced in the last year. Scores of 150 or less indicate little stress; 150–199 mild stress; 200–299 moderate stress; and over 300 major life stress.

Life Events	Life Change Units	Life Events	Life Change Units
Death of spouse	100	Son or daughter leaving home	29
Divorce	73	Trouble with in-laws	29
Marital separation	65	Outstanding personal achievement	28
Jail term	63	Spouse begins or stops work	26
Death of a close family member	63	Begin or end school	26
Personal injury or illness	53	Change in living conditions	25
Marriage	50	Revision of personal habits	24
Fired at work	47	Trouble with boss	23
Marital reconciliation	45	Change in work hours or condition	20
Retirement	45	Change in residence	20
Change in health of family member	44	Change in schools	20
Pregnancy	40	Change in recreation	19
Sex difficulties	39	Change in church activities	19
Gain of a new family member	39	Change in social activities	18
Business readjustment	39	Mortgage or loan for lesser purchase (car, major appliance)	17
Change in financial state	38	Change in sleeping habits	16
Death of a close friend	37	Change in number of family get-togethers	15
Change to different line of work	36	Change in eating habits	15
Change in number of	35	Vacation	13

arguments with spouse			
Mortgage or loan for major purchase	31	Christmas	12
Foreclosure on mortgage or loan	30	Minor violations of the law	11
Change in responsibilities at work	29		

Think back to our chapter opener, where we learned that Ashley recently broke up with her boyfriend, an event that would receive a score of 65 LCUs on Holmes and Rahe's scale. In addition, she has been experiencing troubles with her boss (23 LCUs), school pressures (39 LCUs), and new social activities (18 LCUs). Since she is a relatively new student, we can assume that she changed schools (20 LCUs) and residences (19 LCUs) fairly recently. Add in her outstanding personal achievement of being the first in her family to go to university (28 LCUs), and her LCU score totals 212—a moderate level of stress over a short period of time.

We pointed out that the Social Readjustment Rating Scale includes positive as well as negative life events (see photo). Nevertheless, the scale has been criticized for looking at many more negative events than positive ones and for not including events that do not occur, like not getting a job or promotion you applied for, and for potential differences in the perception of these stressors across cultures (McLean & Link, 1994; Noone, 2017). It is also missing levels of daily background stress that may influence how we respond to the stressors in this scale, thus, the scale may not give a complete picture of the effects of life change on stress levels (Terrill, Gjerde, & Garofalo, 2013).

As mentioned in the last paragraph, another shortcoming of the SRRS is that it does not apply equally to all populations. In developing the scale, Holmes and Rahe sampled mostly Caucasian Americans. Fewer than 5 percent of their participants were African Americans, and none were Native Americans. Subsequent research has shown this bias to be particularly problematic because Caucasian Americans and African Americans often rank life events differently. For example, although both groups rank the death of a spouse as the most stressful life event, African Americans rank personal injury or illness and major changes in work responsibilities or living conditions much higher than do Caucasian Americans (Jackson, 2013; Komaroff, Masuda, & Holmes, 1989, 1986). Similarly, certain types of events, such as the death of a family member, loss of a job, credit problems, and change in residence, are generally more stressful for women than for men (Miller & Rahe, 1997). Alexandra Robinson (2013) at the University of Calgary showed that women from Canadian ethnic minorities experience more psychosocial stress during pregnancy than do non-minority group members.

Digital Vision/Getty Images

Even positive changes can be stressful **Even though they are happy events, marriages produce a high degree of stress according to research using the Social Readjustment Rating Scale.**

As described by Lawrence Kirmayer of McGill University, over the past decades Canada's Indigenous population has experienced a broad and unique array of additional stressors. These include residential schools and the "60s scoop," in which a great many Indigenous children were removed from their communities and placed in non-indigenous foster homes away from family and Indigenous culture and community (see Indigenous Experiences 14.1). This has led to a broad range of additional stresses and challenges that are all parts of their social adjustment stress profiles. As a result, the Indigenous population experiences increased interpersonal problems such as substance abuse, depression, and suicide, as well as increased social problems including high rates of sexual abuse, family violence, and incarceration (Chachamovich et al., 2013; Fraser et al., 2015; Kirmayer, Simpson, & Cargo, 2003).

Life Change and Illness

Holmes and Rahe found that the LCU scores of sick people during the year before they became ill were considerably higher than those of healthy people (Holmes & Rahe, 1989, 1967). In fact, as stated above, if a person's life changes totalled more than 300 LCUs over the course of a year, that person was likely to develop a serious health problem.

The SRRS has been revised by researchers over the years (Hobson & Delunas, 2001; Hobson et al., 1998; Miller & Rahe, 1997). Using various scales, studies have tied a variety of life stressors to a wide range of physical problems, from upper respiratory infection to cancer (Baum, Trevino, & Dougall, 2011; Rook, August, & Sorkin, 2011; Renzaho et al., 2013; Calvo & Morrison, 2016). Generally, the greater the amount of life stress, the higher the likelihood of medical illness. Some researchers have even found a relationship between stress and death. Widows and widowers, for example, have an elevated risk of death during their period of bereavement (King et al., 2017).

Jim Young/Reuters - Images

Early separation **This soldier consoles his young daughter prior to his departure for Afghanistan. Research suggests that family military separations of this kind often take an enormous emotional toll on the children who are left behind.**

Lifespan Development and Stress

Although feelings of stress may be similar for both young and old people, the life changes that evoke these feelings apparently differ widely from age group to age group. As you have just seen, the most powerful stressors (in decreasing order) on the SRRS, a largely adult scale, are death of a spouse, divorce, marital separation, jail term, death of a close family member, and personal injury or illness. But how does stress affect younger age groups?

Researchers have developed special scales to measure life events and stress among traditional college and university students (Crandall et al., 1992; Renner & Mackin, 2002; Slavich & Toussaint, 2013). They have found that the most stressful life event for this population is the death of a family member or friend, much like the top life stressor for adults. Beyond this event, however, the leading life stressors for college and university students are ones that are tied to post-secondary life. They are (again in decreasing order) having to take multiple tests, enduring final exam week, applying to graduate school, being a victim of crime, having assignments in a number of different classes due on the same day, and breaking up with a romantic partner.

Moving to still younger individuals, researchers have found that the leading life stressors for children overlap to some degree with those of adults and college and university students, but, here again, they largely reflect issues unique to childhood (Hess, Shannon, & Glazier, 2016; Sotardi, 2013). (See photo.) Across various scales, the leading stressors for school-aged children are taking tests, having excessive homework, being made fun of or bullied, feeling left out, getting bad grades, getting in trouble, fighting with family members or friends, experiencing the death or illness of someone close, and doing something embarrassing.

It is worth noting that the kinds of life events that produce stress tend to shift as children develop. As children move from 5 years old to 12 years old, physical-type events (for

example, getting sick) become less stressful, behavioural events (getting into trouble) become more stressful, and psychosocial events (fighting with friends) also become more stressful.

Finally, focus on particular life stressors seems to change from generation to generation (Ryan-Wenger et al., 2005). For example, in the 1990s, awareness about a number of different childhood events, such as experiences about being bullied and experiencing violence in school, became more recognized as stressors of childhood and therefore became prevalent items on children's life stress scales. Similarly, during the 2000s, several other powerful childhood stressors have emerged, such as cyber bullying, terrorism, and concerns over post-earthquake nuclear meltdowns.

Traumatic Events

Life changes are stressful because they disrupt the routines of our lives. **Traumatic events** are more extreme disruptions—unexpected events that have the power to change the way we view the world. The earthquakes and tsunamis in Japan in March 2011, the train disaster in Lac-Mégantic in July 2013, and the COVID-19 pandemic of 2020 are examples of the stress-inducing power of single, cataclysmic events (see photo). Sexual or violent assault can also be traumatizing. Such events can have profound and long-lasting effects. Victims may experience a sense of helplessness, depression, anxiety, numbness, and disorientation (Alpass et al., 2016; Carretta & Burgess, 2013). In some cases, the effects can last for years.

traumatic events unexpected events severe enough to create extreme disruptions.

Joe Raedle/Getty Images

Traumatic events A resident wades in flood waters as he waves to a rescue crew in the wake of Hurricane Harvey, which hit Houston, Texas in August 2017. Major disasters, such as this, can be traumatizing for survivors.

Some victims of extraordinarily traumatic events develop **posttraumatic stress disorder (PTSD)**, a condition characterized by persistent, frightening thoughts or memories of the traumatic events, along with anxiety, depression, and other symptoms. We will discuss this disorder in more detail later in this chapter.

> **posttraumatic stress disorder (PTSD)** an anxiety disorder experienced in response to a major traumatic event, characterized by lingering, persistent, frightening thoughts or memories of the traumatic events, along with anxiety, depression, and other symptoms.

Although traumatic events are usually of short duration, some can be ongoing. Suffering ongoing physical or sexual abuse or living with an alcoholic partner or parent are examples of long-lasting traumatic events. These, too, can leave victims withdrawn and experiencing recurring mental images, anxiety, and depression (Carretta & Burgess, 2013).

Fertnig/Getty Images

Chronic Job Stress **Certain jobs produce chronic stress. For example, having to deal with low wages, unpredictable shifts, and physically demanding work environments can lead to chronic feelings of stress that can influence health and well-being.**

Chronic Negative Situations

A negative situation may become particularly stressful if it continues over a long, perhaps indefinite, period of time (Monroe & Slavich, 2016; Schmidt, Sterlemann, & Muller, 2009). People living in a war zone, for example, confront the fearful possibility of an attack as they go about their daily lives, attending school, shopping, or taking the bus to work. Similarly, people who live in poverty face constant concerns about meeting their basic needs and paying their debts (Freeman & Stansfeld, 2014). An ongoing negative home environment—marked by endless arguments with a spouse or child, for example—may produce considerable stress, and so may enduring workplace problems, such as continually feeling underpaid, unappreciated, bored, or in danger of being fired (Grawitch, Ballard, & Erb,

2015; Son & Peterson, 2016). (See photo.)

Chronic illnesses can also produce much stress over time. Such illnesses may not only cause pain, but also impose limitations and produce feelings of mortality and uncertainty in people's lives. The patients themselves are not the only ones affected by chronic illnesses; their caregivers also experience stress. Thus, parents of children with special needs—whether enduring illnesses, physical handicaps, intellectual disability, or other conditions—often experience stress. So do the growing numbers of adults who must take care of aging parents or spouses. In fact, research indicates that such caregivers often suffer from depression, drink excessively, are sleep deprived, and engage in fewer healthful behaviours, such as exercise (Do, Cohen, & Brown, 2014; Zarit et al., 2017).

The physical environment may also provide chronic stressors. Chronic noise, for example, often leads to tension and upset (Burns et al., 2016; Ferguson et al., 2013). Similarly, chronic overcrowding leads to higher bodily arousal and makes it difficult for people to relax (Hotwani & Tripathi, 2017). Chronic environmental stressors may interact with each other. A noisy roommate, may be both a physical and a social stressor. The roommate's loud music may bombard you and leave you with frequent headaches; at the same time, the tense relationship that develops between the two of you may produce further stress.

Socio-cultural Conditions

Socio-cultural conditions, such as those faced by members of ethnic minority groups who regularly confront prejudice, can be sources of stress (Alamilla et al., 2017). Work by McGill University's Laurence Kirmayer and others clearly shows that minority-group members, including those in Canada's First Nations and Métis populations, face special challenges and stressors as they try to navigate through the dominant culture (Chachamovich et al., 2013; Kirmayer, Sheiner, & Geoffroy, 2016). Foreign workers participating in Canada's temporary foreign worker program, for example, have to adjust to new ways of doing things, learn a new language, and often contend with poverty and the stress of a crowded living situation. In addition, members of minority groups often have to try to balance the demands of two cultures—their own culture and that of the dominant culture in which they live. If they are not proficient in the language or nuances of the dominant culture, they may also experience the stress of isolation and of having limited access to the main channels of communication within the dominant culture (Strauss & McGrath, 2017).

And even when minority-group members achieve success in the dominant culture, another source of stress can emerge as individuals find themselves having to assess the role that prejudice and discrimination may have played in their interactions with the dominant culture. For example, consider Jonathan, an Indigenous Canadian man working in advertising at a large department store. Jonathan's job is to produce advertisements for special sales of fall clothing. His boss, who is Caucasian, doesn't think much of the two ideas Jonathan has proposed and tells him so. In addition to feeling disappointed and perhaps angry about the rejection of his ideas, Jonathan may experience the further stress of wondering whether his boss was reacting to his Indigenous status or to his ideas. The suspicions, confusion, and resulting vigilance experienced by minority-group members as they interact with majority-group members, often referred to as *stereotype threat*, is a very real stressor for minority-group members, but is often invisible to those in the majority group (Schmader, Hall, & Croft, 2015; Spencer, Logel, & Davies, 2016).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

1. What is the difference between an acute stressor and a chronic stressor?
2. What are the four types of stress experiences?
3. Define the three basic types of conflict.
4. What are daily hassles and what is their impact on health?
5. What is the Social Readjustment Rating Scale?

What Do You Think? • What kinds of situations do you find especially stressful? How do they compare with what your friends find stressful? What do variations in the experience of stress tell us about stress and stressors?

Responding to Stress

LEARNING OBJECTIVE 2

Describe the physiological, emotional, and cognitive responses to stress, and explain how individual responses to stress differ.

We have looked at the kinds of experiences that cause stress. Let's turn next to what happens to people when they experience stress. Responses to stress fall into three general types: physiological, emotional, and cognitive. As you might expect, people vary greatly in their responses.

Physiological Responses to Stress

Although what happens in the brain is critical to the stress response, responses to stress affect both the brain and the body. Think about how you come to know that you are under stress. Typically, your breathing and heart rate quicken, you begin to sweat, your mouth gets dry, and your stomach tightens. What's happening is that your brain has perceived a challenge and is sending signals to your body to prepare to meet it. This response to stress involves a brain–body reaction. Sweating, dry mouth, and stomach tightness are some of the immediate physical effects of stress, but these effects are actually indicators of more basic physiological responses. We examine these responses next and illustrate them in **Figure 14.2**.

The Fight-or-Flight Response

You may remember the discussion of physiologist Walter Cannon's theory of emotion in Chapter 11. Cannon was the first theorist to connect the bodily arousal associated with emotional responses to the need to fight or flee. According to Cannon (1932), the fight-or-

flight response is a series of physiological reactions throughout the sympathetic nervous system and the endocrine system that mobilize an organism to either fight or flee an enemy. The process begins in the brain. The brain sends messages to the endocrine glands and bodily organs along two different routes. One is through the sympathetic nervous system, which as you recall is a division of the autonomic nervous system (ANS). The other is through the hypothalamic-pituitary-adrenal (HPA) axis (Daskalakis et al., 2016; Sarafino et al., 2015).

Geoff Howe/The Canadian Press

Under fire **Riot police were in extreme danger, and likely had high levels of cortisol, a stress hormone, in their bloodstream, during the riot following the Vancouver Canucks' loss during the 2011 NHL playoffs.**

When we confront a dangerous situation, within milliseconds the brain sends messages to the sympathetic nervous system, and these nerves directly stimulate organs of the body (the heart and lungs, for example). (See photo.) The nerves also influence organs indirectly by stimulating the adrenal glands (located at the tops of the kidneys), particularly the inner layer of those glands, an area called the *adrenal medulla.* The adrenal medulla, in turn, releases the chemicals epinephrine and norepinephrine (otherwise known as adrenaline and noradrenaline) into the bloodstream, where they are carried to various organs and muscles, further arousing the organism and enabling it to fight or flee. Normally, the biological changes associated with the fight-or-flight response subside around 15 minutes after the threatening situation eases (Sarafino et al., 2015). (See photo.)

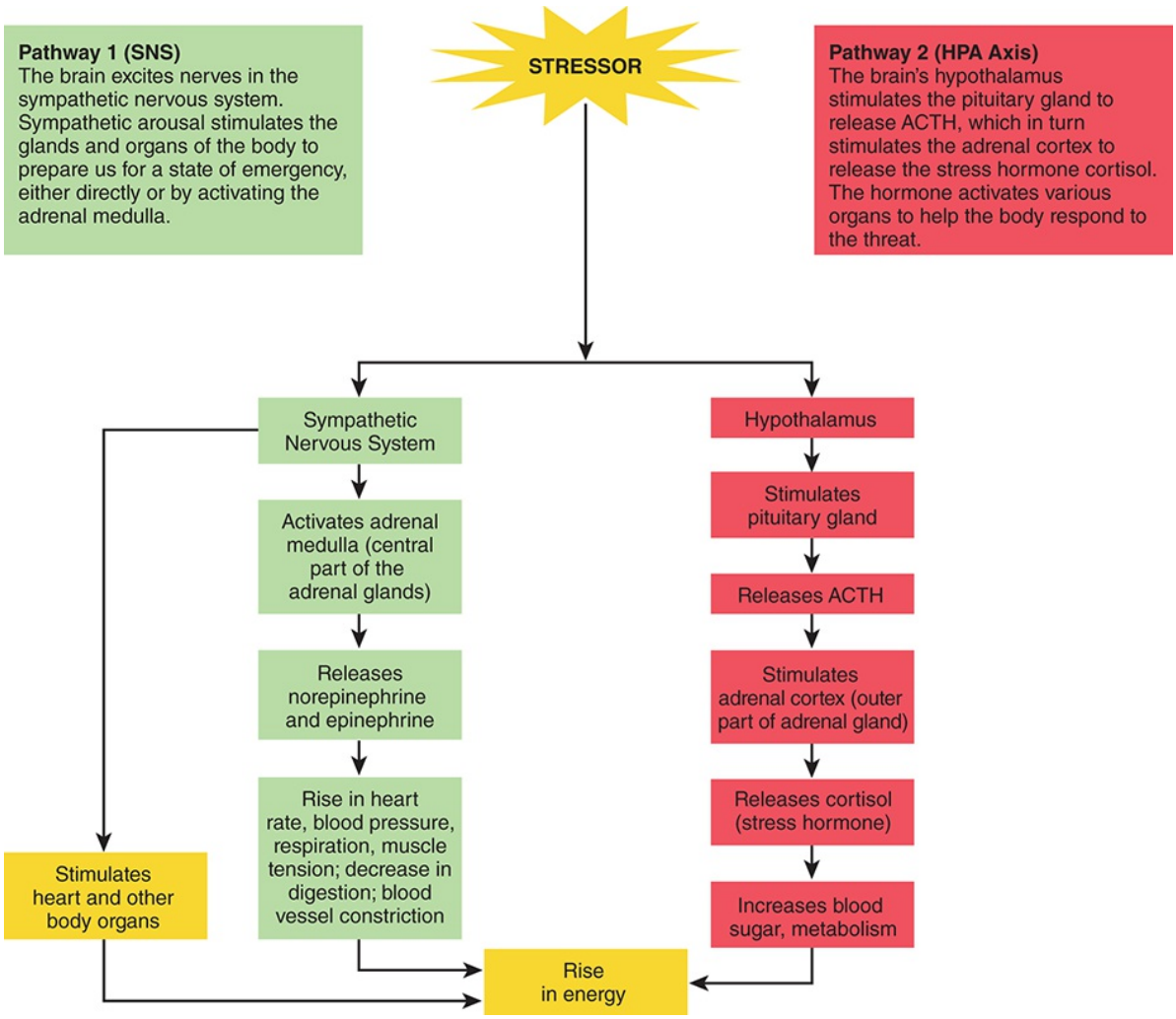


FIGURE 14.2 The physiological response to stress **The brain sends messages to the endocrine glands and bodily organs through the sympathetic nervous system (SNS) pathway and the hypothalamic-pituitary-adrenal (HPA) axis.**

Diverse Images/UIG/Getty Images

Fight-or-flight response **When faced with a dangerous or stressful situation, our brain sends messages to the sympathetic nervous system, which triggers various reactions in the body (such as the release of cortisol to supply energy) to prepare the body for the fight-or-flight response.**

When we are confronted by stressors, the hypothalamus, stimulates the pituitary gland, prompting the gland to release *adrenocorticotropic hormone (ACTH)* into the bloodstream. ACTH travels to the adrenal glands and interacts with their outer covering, an area called the *adrenal cortex*, causing the release of stress hormones called *cortisol*.

Cortisol travels, via the bloodstream or circulatory system, to a range of body organs, where it leads to elevations in blood sugar, which supplies energy to the organism under stress. In this way, cortisol helps prepare individuals who are under stress to engage their fight-or-flight response (Plaford, 2013; Russell & Lightman, 2019).

These two systems (the sympathetic nervous system and the HPA axis), activated in tandem, ensure that the organism is able to mobilize its energy to deal with a crisis, even if it takes a while. As you will see later in the chapter, however, problems can arise if cortisol activity remains high for too long. It can then become harmful, contributing in some cases to high blood pressure, inflammation, anxiety, and depression, among other problems (Do Yup Lee & Choi, 2015; Kendall-Tackett, 2010).

The fight-or-flight response is an early evolutionary adaptation. You can imagine how this kind of reaction might have helped early humans survive. If they suddenly came upon a grizzly bear, they were better able to either overwhelm it or escape in a hurry. But many of the stressors we face today are more subtle and more chronic—homework stress, employment pressures, relationship difficulties, and any number of other conditions. What happens when a stressor is chronic? Hans Selye considered that question in forming his theory of the general adaptation syndrome.

The General Adaptation Syndrome

Hans Selye was an Austrian-born endocrinologist who immigrated to Canada in 1939. He

worked at McGill University and the University of Montreal and is credited with first talking about stress in living creatures (Greenberg, Carr, & Summers, 2002; Selye, 1993, 1956, 1936). In his laboratory, Selye exposed animals to a variety of stressors. No matter what the stressor—mild shock, pain, restraint, heat, cold—he found that the animals displayed the same pattern of response: a consistent pattern that he labelled *stress* (a term he borrowed from engineers, who use it when they discuss forces that affect the structural integrity of the things they build). Selye believed we respond in much the same ways to stress, whatever its source. This insight was particularly important, because it means that, although our responses to different stressors might vary in degree, we are responding in the same basic way to all of them.

Selye also noticed that if stressors continue, the organism's body progresses through three stages of response: alarm, resistance, and finally, exhaustion. He called this three-stage response to stress the **general adaptation syndrome (GAS)** (see **Figure 14.3**).

general adaptation syndrome (GAS) a three-stage response to stress identified by Hans Selye; the stages are alarm, resistance, and exhaustion.

STAGE 1: When an organism is first exposed to a threat, it reacts with *alarm* and becomes aroused physically as it prepares to face the challenge by fighting or fleeing. In short, the first stage of the general adaptation syndrome corresponds to the fight-or-flight response. Because our system is focused on the stressful event or situation and mobilizing us physiologically to deal with it, our resistance to the stressful event (shown by the red line in Figure 14.3) is reduced (see photo). If the stress is too powerful, it could overwhelm us.

STAGE 2: If the threat continues, the organism's body undergoes further changes in an attempt to stabilize itself—a second wave of adaptation that Selye called *resistance*. The organism's level of arousal is elevated, though slightly lower than during the initial alarm phase, as it adjusts to the stressor. If new stressors are introduced during this stage, the body is less able to marshal the energy needed to address them as it is engaged in resisting the previous stress. According to Selye, this makes the body vulnerable to *diseases of adaptation*—health problems, such as high blood pressure, asthma, and illnesses associated with impaired immune function.

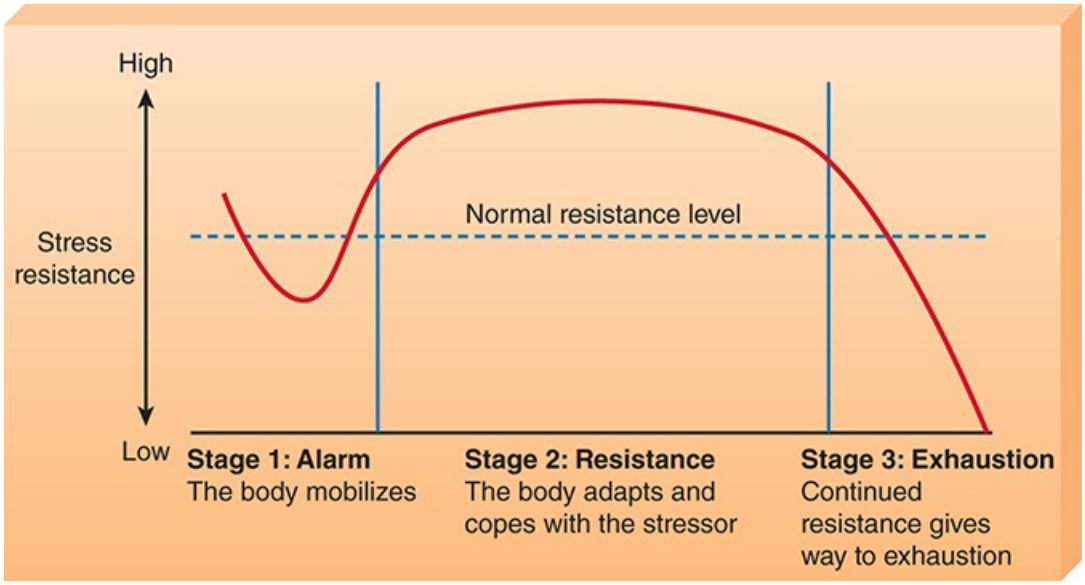


FIGURE 14.3 The general adaptation syndrome Selye proposed that the body's physiological response to prolonged stress has three stages. The red line in this figure shows the level of physiological resistance to a prolonged stressful event.

Darryl Dyck/ZUMA Press/Newscom

The alarm mode can save lives As a wildfire moved closer to Boston Flats, BC, in July 2017, residents moved into an alarm mode, fleeing the fire as quickly as possible.

STAGE 3: If the organism is exposed to the stressor for still longer periods of time, its resistance gradually gives way to the third stage, *exhaustion*. In this stage, the body is depleted of energy and has little ability to resist. If the threat continues, the organism can suffer organ damage or death.

Students who have gone through final exams often have firsthand experience with Selye's

general adaptation syndrome. As the exams approach, most students experience alarm. When they gear up and begin patterns of late-night studying, the students are entering the resistance phase. By the end of the exam period, many students feel as if they are heading toward exhaustion, and, in fact, a number catch colds or develop other illnesses at the end of the school year. If you haven't gone through a final exam period yet, you will soon have a chance to gather your own data on this student experience.

Although the principles of Selye's theory are widely accepted today, some theorists, such as Sonia Lupien at the University of Montreal, have questioned his claim that the stress response is the same no matter what the stressor (Lupien et al., 2007, 2006; Souza-Talarico et al., 2011). Lupien points out that although Selye used many kinds of stressors in his experiments with animals, all were physical—pain, heat, cold, and so forth. As we shall soon see, psychological factors also play an important part in our stress experience.

Emotional Responses to Stress

Bodily arousal is only one dimension of our reaction to stressors. When people feel threatened by an event or situation, they typically experience a change in mood or emotions as well. Let's briefly revisit Ashley, the stressed-out student from the chapter opener. As the stressors in her life mount, Ashley feels increasingly dejected (she wants to curl up in a ball), annoyed (her inquisitive parents are "driving her crazy"), anxious (she had to leave her public speaking class in the middle of a speech), and angry (during an argument with Jason, she called him a jerk).

Note that most of Ashley's emotional responses to stress are negative. This is typical of people under stress. Researchers have found that the more stress a person experiences, the more negative their emotions, especially for individuals who are predisposed to anxiety and depression (Baqutayan, 2015; Eberhart et al., 2011; Lazarus, 2007, 1999, 1993a, 1993b; Ruscio et al., 2015). People who generally live under severe stress tend to be more anxious, depressed, or otherwise upset than those who have relatively stress-free lives. Even within the course of a day, people feel more negative when short-term stressors emerge. Conversely, as perceived daily stressors subside, people's moods take an upward turn (Lacaille et al., 2018).

It was once thought that certain negative emotions—anxiety and depression—were more likely than others to emerge during stress. However, researchers have learned that, in fact, a range of different negative emotions may accompany stress, depending on an individual's personal style and on the stress-inducing situations. The most common emotional reactions include anxiety, fear, and apprehension; dejection and grief; annoyance, anger, and rage; guilt; shame; disgust; and jealousy (Baqutayan, 2015; Lazarus, 2007, 1993a, 1993b). See Positive Psychology 14.1 for a discussion of one way to reduce stress during emotionally heightened situations such as final exams.

Cognitive Responses to Stress

As we noted at the beginning of the chapter, a key feature of stress is how we *appraise* both the challenging situation and our ability to handle that situation. If asked to speak publicly, for example, one person may be excited and pleased at the opportunity, while another may be fearful and anxious (see Your Brain and Behaviour 14.1 later in this chapter).

Sometimes, as in the fear of public speaking, this appraisal is stable—that is, people tend to react consistently to the prospect of speaking before a group. In other situations, however, the appraisal depends on the person's present psychological state. For example, we may appraise a missing car key as much more stressful on the day of a final exam than on a less eventful day.

14.1 Psychology Around Us | Positive Psychology

Exam Stress and Dog Therapy

Most people have experienced exam anxiety at some point in their lives, and university students perhaps more than others are susceptible to anxiety before an important exam. This anxiety can be great or small, but the larger the level of anxiety, the worse your performance can be when actually taking an exam. While there are many techniques for managing exam anxiety, one tactic that has recently come to the fore is the use of therapy dogs, that people can play with and pet to help them relax, before exams.

Studies have shown that exposure to a therapy dog in the hours before an exam can significantly decrease perceived stress (Barker, Barker, McCain, & Schubert, 2016). Other studies show that the effect of a therapy dog session is relatively long lasting (Ward-Griffin et al., 2018) and produces a number of positive effects—including improved affect, perceived social support, and perceived stress levels—for several hours. Recent pilot evaluations of therapy dogs at the universities of Saskatchewan, Regina, and McMaster have shown that having therapy dogs on campus was linked to lower levels of stress and increased relaxation in the majority of the participants in the study (Dell et al., 2015).

Dog therapy sessions are not just beneficial to those getting ready for that all-important exam. Indeed, dog therapy sessions have been shown to lower stress levels, decrease anxiety, and promote feelings of support and well-being for many categories of individuals under stress, including war veterans, first responders, and people dealing with traumatic life changes, such as the death of a spouse or a dire medical diagnosis (Tsai, Friedmann, & Thomas, 2010; Swall et al., 2019; Yount, Olmert, & Lee, 2012).

Cavan Images/Getty Images

De-stressing with a friend **Interaction with a friendly canine can reduce general levels of stress and anxiety – especially during the final exam period – for many students.**

Remember Richard Lazarus and his cognitive-mediational theory of emotions, discussed in Chapter 11? Lazarus believed that emotion is aroused by a combination of two elements—an environmental event and personal factors such as a person's motives and beliefs. In fact, much of his early work was focused specifically on stress, and he identified two steps in how we experience stress (see **Figure 14.4**).

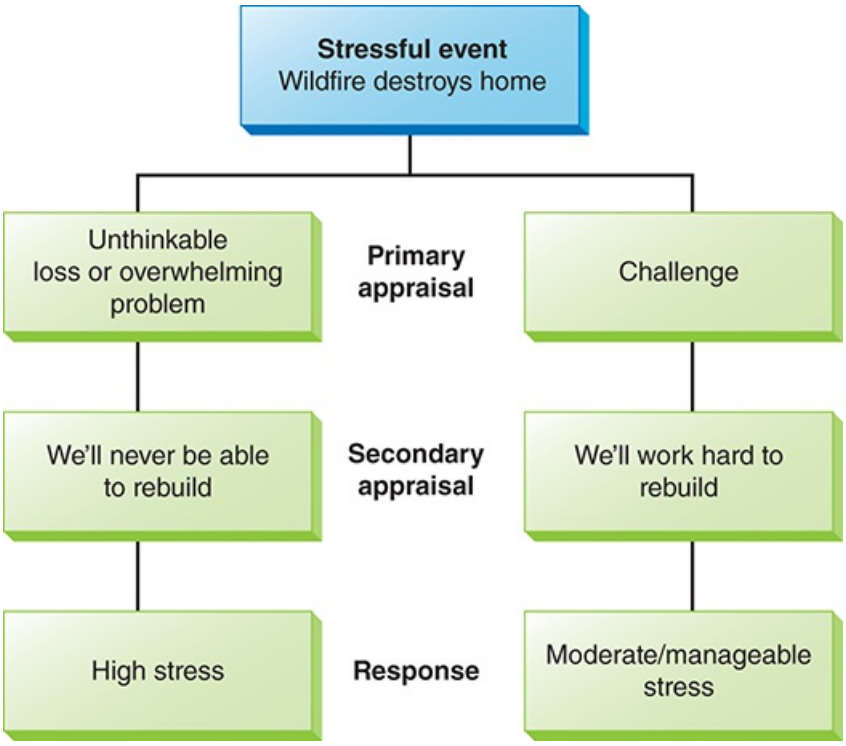


FIGURE 14.4 The cognitive-mediational theory of stress **Our level of stress largely**

depends on how we appraise a threat and evaluate our abilities to cope with it.

In the first step, **primary appraisal**, we examine the stressor and assess how severe it is. We may identify the stressor as a future danger (a threat), a current situation to be confronted and overcome (a challenge), or a loss or harm. The way we appraise the stressor in this first step can have important consequences for how we attempt to deal with it. Ashley, for example, appraised her term paper as a threat to be avoided rather than a challenge to be overcome.

In the second step, we evaluate our own resources and ability to cope with the threat, challenge, or loss. This step is called **secondary appraisal**. Perceiving ourselves as lacking the resources to deal with a problem will elevate its threat level. Conversely, by reminding ourselves of what resources we have, we can quickly decrease the threat level. Consider Ashley's more positive attitude when she musters her resources and quickly produces a few paragraphs of her paper.

primary appraisal appraisal of a stressor to determine how severe it is; the first stage in Richard Lazarus's description of how people experience stress.

secondary appraisal appraisal of one's personal resources and ability to cope with a stressor; the second stage in Richard Lazarus's description of how people experience stress.

One common factor in these appraisals is that the degree to which we feel in control of a situation affects how dangerous or stressful it feels. Perceptions of control (or lack of control) can greatly influence our appraisal of a stressor and, in turn, our experience of stress. Persons who believe that they can exert control over a particular stressor will experience less stress than individuals who feel no such control. A study of residents in a nursing home, for example, found that persons who were given more control over their lives (such as deciding when to attend a movie or where to receive visitors) experienced less overall stress than residents given little control. Residents with control were also twice as likely to still be alive 18 months after the study began (Golub & Langer, 2007; Langer & Rodin, 2004; Rodin & Langer, 1977).

It is important, of course, that our sense of control be realistic. People with life-threatening illnesses such as cancer or heart disease who think that they can control their disease with unproven remedies may feel less stress initially, but they are not likely to be healthier for their efforts. Patients with such illnesses can, however, experience a realistic sense of control (and a lower level of stress) by managing specific aspects of their diseases (seeking out useful medical information, for example), taking part in treatment decisions, controlling some of their emotions, and seeking closer relationships with their loved ones (Doka, 2013; McKinley et al., 2012).

Individual Responses to Stress

It should be clear by now that when it comes down to it, how stressed someone gets in a particular situation often depends on whom we're talking about (see photos). You probably have friends who collapse at the slightest hint of trouble, and other friends who are experts in crisis management. Perhaps you have other friends who just let trouble roll off their

backs without even a suggestion of worry.

MachineHeadz/iStockphoto.com

Prostock-studio/Shutterstock.com

deeepblue/iStockphoto.com

Displaying stress Each child displays a different reaction to the first day of school: one seems overwhelmed (left), another frustrated and angry (middle), and the other unfazed (right).

Individuals are unique in many ways. Each of us has a particular biological makeup, a preferred style of interpretation, and a unique cluster of personality traits. In addition, we each operate within a particular social context. These individual differences profoundly influence our physical, emotional, and cognitive responses to stress. Researchers have spent considerable energy examining four areas of individuality and their relationships to stress: *autonomic reactivity*, *explanatory style*, *personality*, and *social support*.

Autonomic Reactivity and Stress

Earlier, we observed that the autonomic nervous system (ANS), particularly the sympathetic nervous system, plays a key role in stress reactions. When a person confronts a stressor, the ANS stimulates organs throughout the body, triggering feelings of physical arousal. As you might expect, people differ in how intensely the ANS responds to stressors. In some, the ANS tends to be highly reactive across various situations and springs into action, even in response to mild stressors. In others, the ANS is less reactive and so less likely to respond even to fairly significant stressors. Such basic differences in *autonomic reactivity* may cause some people to experience stress reactions more often or more intensely than other people, even in the face of identical environmental threats. In turn this difference can influence the development of disorders such as depression and anxiety in children and adults (Dieleman et al., 2016; Hu, Lamers, de Geus, & Penninx, 2016).

To illustrate, let's look at cardiovascular responses to stress, which include blood pressure and heart rate. In a number of studies, researchers have measured the cardiovascular reactions of individuals confronting stressors, such as difficult cognitive or social tasks (Dhabhar, 2014; Phillips, 2016). Across a variety of situations, certain participants repeatedly display high cardiovascular reactivity, while others consistently exhibit low

cardiovascular reactions.

Explanatory Style and Stress

The characteristic manner in which we explain events, our *explanatory style*, can make a difference in how we appraise and respond to stressors. People with generally *optimistic* explanatory styles tend to believe that, despite setbacks, things will improve (Kleiman et al., 2017; Reed, 2016). Those with generally *pessimistic* explanatory styles have a gloomier appraisal—they believe that if things can go wrong, they usually will go wrong (Liu & Bates, 2014).

Imagine two people, each failing to make the first-string college or university soccer team. Both feel disappointed and sad. One says to herself, "I'll never make it. I'm such a dud. I should never have tried out. It was stupid of me to think I was any good at soccer." In contrast, the other individual says, "At least I tried. If I do track in the spring, I can improve my speed and make the team next year. Meanwhile, I'll talk to the coach and find out how I can improve." It is likely that the latter individual—the more optimistic one—will experience less stress than the former.

Research has supported the idea that optimistic and pessimistic explanatory styles influence stress reactions (Carver & Scheier, 2017). When optimistic research participants appraise stressful situations, they are more likely than pessimists to recognize positive features of the situation and to perceive the situation as manageable (Littmen-Ovadia & Nir, 2014). In turn, those with optimistic explanatory styles typically experience lower levels of stress (Birkeland, Blix, Solberg, & Heir, 2017). Similarly, it turns out that optimists are more likely to seek out social support during stressful events and to employ constructive coping techniques, including the use of social networks for social support (Carver, Scheier, & Segerstrom, 2010; Nabi, Prestin, & So, 2013). (We will discuss the importance of social support later in this section.)

Of course, few people are exclusively pessimistic or exclusively optimistic, although they may lean in one direction or other. In fact, some individuals develop an *optimistic brand of pessimism*. These individuals believe that things will go wrong but, at the same time, hope that they won't: "I probably will fail to make the soccer team, but maybe I'll get lucky. If I play my best and the others have problems, I might have a chance." Still other people are *defensive pessimists*. They anticipate negative outcomes largely to help protect themselves from disappointment (del Mar Ferradas et al., 2017; Roy Chowdhury, 2016). Deep down, they hold out hope for the best, and so manage to preserve a degree of optimism.

Personality and Stress

Our personalities often help set the tone for how we appraise and react to stressors (Hengartner, van der Linden, Bohleber, & von Wyl, 2017; Stroud, Sosoo, & Wilson, 2015). People who are generally timid will likely greet a stressor with more alarm than people who are generally bold. Similarly, our ongoing levels of anger, depression, curiosity, and related feelings will influence our stress reactions. Ashley's breakup, for example, appeared to be precipitated by her general tendency to react to stressors by becoming moody and critical.

One personality style that has been studied is the *hardy personality*, sometimes called the

stress-resistant personality (Bartone, 2003; Maddi, 2014; Ouellette & Di Placido, 2001). Individuals with such personalities welcome challenges and are willing to commit themselves and take control in their daily lives. Generally, they greet stressors as opportunities for growth rather than as crises, and perceive stressors as less severe than non-hardy individuals. Not surprisingly, hardy persons also seem to experience fewer and less intense feelings of stress (Abdollahi, Abu Talib, Yaacob, & Ismail, 2015).

At the other end of the stress continuum are people with personality styles that appear to make them more prone to stress. In the late 1950s, two cardiologists, Meyer Friedman and Raymond Rosenman (1959), reported that many of their heart patients seemed to share similar personality traits: they were consistently angry, cynical, hard-driving, impatient, and time conscious. They were also competitive, ambitious, and in a hurry to do many things at once. Friedman and Rosenman claimed that individuals with this personality style, which they labelled **Type A**, interact with the world in a way that produces continual stress (Friedman & Rosenman, 1959; Jamal & Baba, 2003; Smith & Gallo, 2001; Miller, 2000). In contrast, people who display **Type B** personalities are more relaxed, less aggressive, and less worried about time. People with this personality style are thought to experience lower levels of stress. In fact, most people fall between these two extremes, leaning toward one or the other but showing features of both personality patterns.

> **Type A** a personality type characterized by competitiveness, impatience, and anger and hostility.
>
> **Type B** a personality type that is less aggressive, more relaxed, and less hostile than Type A.

Researchers later suggested there might be a third personality pattern, **Type C**. People with this personality type are pleasant and peace loving, but have a hard time expressing or acknowledging negative feelings (Temoshok, 2003; Temoshok et al., 2008). Although their positive attitudes might be thought to protect them from stress, persons with Type C behaviour patterns are actually particularly vulnerable. When angry, Type C personalities tend to turn the anger inward. They also tend to take losses and relationship problems particularly hard. Recently researchers have identified a **Type D** personality pattern characterized by negative affectivity such as worry or gloominess and social inhibition. The "D" stands for distressed, and this personality pattern seems to have a number of health implications (Schoormans et al., 2017; van den Tooren & Rutte, 2016). We will talk more about Type A, Type B, Type C, and Type D personality types when we discuss the relationship between stress and health later in the chapter.

> **Type C** a personality type characterized by difficulty in expressing or acknowledging negative feelings.
>
> **Type D** a personality type characterized by negative affectivity such as worry or gloominess and social inhibition.

Social Support and Stress

As we think back to Ashley's struggle at the beginning of the chapter, notice that she seems

to be going through her difficulties alone, without much social support. She does not feel free to turn to family members, and she does not appear to have close friends in whom she can confide. In fact, family and social relationships seem to add to her experience of stress. Would Ashley have felt better if she could have turned to family members or friends for support? The answer is yes, not only for humans but also for our closest primate relatives, chimpanzees, according to numerous studies and observations (Levens, Elrahal, & Sagui, 2016; Stein & Smith, 2015; Taylor, 2011; Wittig et al., 2016).

Richard Heathcote/Getty Images

Social support can make the difference A Korean golfer comforts her playing partner as the latter is sizing up a difficult putt on the 18th green of the Women's World Cup of Golf in 2008. The partner went on to sink the putt.

Social relationships can be paradoxical. On the one hand, as in Ashley's case, negative interactions with or a lack of social support from relatives and friends can be sources of significant stress (Taylor, 2011; Wickham, Taylor, Shevlin, & Bentall, 2014). On the other hand, studies have resoundingly indicated that social relationships and support, in person or via online social networks, help prevent or reduce stress reactions (see Psychology Around Us 14.1) (Dunkley, Solomon-Krakus, & Moroz, 2016; Frison & Eggermont, 2015).

The positive impact of social support on stress was first revealed in animal studies. In a classic study, twin goats were subjected to a stressful conditioning task. One goat worked in isolation and the other worked in the presence of its mother. The goat working in isolation reacted with greater anxiety and stress than did its twin (Liddell, 1950). In another classic study, a group of mice had to "share" a common feeding place, which created a persistent state of territorial conflict (Henry & Cassel, 1969). In one condition, the mice in the group were strangers, while in the other the mice were from the same litter. The former group showed more signs of stress than did the latter. These classic studies have been followed up with studies in a variety of other animals and the results resoundingly support the role of social support in mitigating stress (Beery & Kaufer, 2015; Feder, 2019; Takahashi, Flanigan, McEwen, & Russo, 2018).

Studies of humans have revealed a similar role for social support in stress reactions (Levens et al., 2016; Taylor, 2011). It has been found, for example, that when faced with various job stressors, ranging from work overload to job conflict, workers who can rely on their supervisors, co-workers, and spouses for emotional and practical support often experience less distress than workers without such support (Carpenter et al., 2015; Woodhead, Northrop, & Edelstein, 2016). Other studies suggest that having an intimate, confiding relationship with someone, whether a spouse, close friend, or other individual, provides the strongest kind of social support (Olpin & Hesson, 2013). (See photo.)

Why do people who have strong social support seem to experience less stress? Researchers are not sure. Such support may increase people's self-confidence or self-esteem as they confront stressors. It may provide individuals under stress with a greater sense of control or greater optimism that everything will turn out well. Alternatively, social feedback may change people's perspectives as they face stressors, alter their perceptions of threat, or reduce their appraisal of a stressor's importance. Finally, it may be that the reassuring presence of close friends or relatives helps to reduce the kinds of bodily arousal and negative emotions that normally feed stress reactions (Levens et al., 2016; Taylor, 2011).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

6. How do the sympathetic nervous system and hypothalamic-pituitary-adrenal pathways influence our experience of stress?

7. What happens in each stage of the general adaptation syndrome?

8. What is the difference between primary appraisal and secondary appraisal?

9. How does autonomic reactivity affect how different people experience stress?

10. What are the characteristics of the hardy personality type?

What Do You Think? • Can you think of any advantages to having a Type A personality? A Type C personality? Can you think of any disadvantages to having a Type B or a type D personality?

Coping with Stress

LEARNING OBJECTIVE 3

Discuss and evaluate several ways in which people cope with stress.

We have seen that a number of individual differences contribute to how stressed we become. Once we feel stressed, we also differ in our efforts to manage the situation. What do you do when you feel stressed? If you feel overloaded or overburdened, do you lie in bed

worrying about all that you have to do, unable to get started, or do you start making lists and timetables? If you are in a traffic jam, do you pound the steering wheel, or do you instead try to find an interesting radio station or play your favourite song? Faced with the worrying prospect of a chemistry midterm, do you call a friend to study or light a cigarette?

14.2 Indigenous Experiences

Coping with Stress

Most residential school survivors who spoke to the Truth and Reconciliation Commission spoke of neglect, sexual and physical abuse, trauma, despair, illness, crippling fear, and overwhelming loneliness and homesickness. However, some also spoke of "qualified benefits" such as forming important and sustaining friendships, skills acquired, field trips, movies, access to books and comics and, for a very few, escape from even worse home environments. Survivors especially enjoyed the times they got to be outdoors, reporting, "We go sliding. We play all kinds of games on the lake and, oh, we'll just have fun" (McNeely, 2010, p. 187) or, "When we were in the woods, we felt free, or we were down on the beach by the water, collecting food that we were used to eating" (Charleson, 2010, p. 187). As well, although not common, some residential schools provided students with chances to engage in organized sports or other forms of recreational activity. Many survivors given these opportunities reported that these extracurricular activities provided them with a refuge from the degradation, fear, and anxiety that characterized their day-to-day existence. For many, these experiences in the gym or on the field provided them with a much needed sense of accomplishment, "And there was times when I was called dumb and stupid and there were times when I felt dumb and stupid. But put me in a gym, there was not too many people better than I am" (Andrew, 2011, p. 189). For others, activity simply provided a means of temporary escape, "I was quite athletic, and basically, that's what kept me alive. That's what kept me going was the sports." (Kimball, 2011, p. 189) and, "One of the good things that I would do to try and get out of just the abuse was try to, I would join track meet, try and be, and I was quite athletic in boarding school" (Shingoose, 2010, p. 189). However, for others the abuse from the school simply extended to the sports arena, "When we were losing, we were getting beaten with a ruler. We always had to win. We didn't know how to lose. It was always, win, win" (Papatie, 2012, p. 190). But even for those for whom the gym or team offered solace, it was not enough. One student athlete, who later played professional hockey said, "I didn't want to be an athlete, I didn't want to be a hockey player, I didn't want to be anything. All I wanted was my parents" (Sasakamoose, 2012, p. 193).

Matteo Omied/Alamy Stock Photo

Team sports **Many survivors reported that during their time in residential schools, team sports and the ability to be outdoors provided a welcome respite from many of the hardships they experienced in their day-to-day lives.**

Critical Thinking Questions

What type of coping strategies are referred to in this box? Which do you think was most effective and why?

What role, if any, would cognitive appraisal play in the situations discussed in this box?

How might the role of exercise become an additional stressor, rather than a coping mechanism, in the situations described in the box?

Our efforts to manage, reduce, or tolerate stress are called **coping**. Although most people use this term to convey constructive efforts ("I'm coping with the situation"), a coping response may be either adaptive or maladaptive in a given situation (Folkman & Moskowitz, 2004; Kleinke, 2007). For a person faced with failing grades, for example, going out and partying or spending a lot of time video gaming are less adaptive coping responses than spending extra time studying. Each of us has preferred styles of coping that we tend to apply across various situations (Aldwin, 2007; Carver & Scheier, 1994, 2003; Folkman & Moskowitz, 2004). A person may use different coping responses in different situations, however, and some *coping-flexible* individuals are more able than others to depart from their preferred coping styles to meet the demands at hand. Let's look at some of the more common coping styles (see Indigenous Experiences 14.2).

coping efforts to manage, reduce, or tolerate stress.

Humour

In a 1998 film, Robin Williams donned a white coat and a red clown nose and took a new

brand of medicine to movie theatres around the world. He was playing real-life physician Patch Adams, who believes that the medical community has failed to embrace the use of laughter and humour to aid in health and healing (Marsh, 2008). (See photo.) While this may be a feel-good sentiment, is there actual support for the notion that laughter is the best medicine? Research results from medicine and psychology are mixed in their support of a laughter–health link (Booth-Butterfield & Wanzer, 2017). For example, humorous film watching where viewers laughed has been correlated to decreases in stress and improvements in their immune system activity (Bennett, 1998; Kantha, 2015; Monahan, 2015). On the basis of such supportive findings, psychologists have offered various explanations for how laughter might improve health (Gonot-Schoupinsky & Garip, 2018; Savage, Lujan, Thipparthi, & DiCarlo, 2017). Some of these explanations suggest that there is a direct link between laughter and health. One proposal, for example, holds that laughter may increase blood flow, thereby reducing blood pressure (Dolgoff-Kaspar et al., 2012). Another proposal argues that 100 laughs can provide an aerobic workout equal to 15 minutes on an exercise bike (Brickey, 2005). Still other scientists suggest that the link between laughter and health is an indirect one. One popular proposal, for example, supported by research conducted by Elsa Marziali at the University of Toronto, suggests that humour results in greater social support, thereby aiding health, and that humour may help heal by bringing down a person's stress level (Marziali, McDonald, & Donahue, 2008).

Jessica Teft/Keystone

A different approach The real Patch Adams, physician and clown, talks here to the sister of a hospitalized child.

Other research suggests that support for the humour–health link is less clear and perhaps more questionable than first thought. Some studies on this subject have failed to support the link (Cho & Oh, 2011). Clearer verdicts on the strength of this relationship and on the theories that seek to explain it await the results of current and future research. In the meantime, there is nothing in the literature to suggest laughter is bad for one's health, and many health and humour experts have offered tips on how to increase one's daily quota of

good humour. They suggest, for example, browsing through the humour section of a local bookstore; keeping a humour journal filled with funny newspaper headlines, bumper stickers, and notes about humorous events; and reading cartoons daily, making sure to save and post the ones that tickle your funny bone the most (Savage, Lujan, Thipparthi, & DiCarlo, 2017).

Meditation

Meditation is a technique designed to turn one's consciousness away from the outer world, toward inner cues and awareness, ignoring all stressors (Butler, 2011; Van Dam et al., 2018). The technique typically involves going to a quiet place, assuming either a specific body position or simply a comfortable position, controlling one's breathing, limiting one's outward attention, and forming internal images (see photo). The result of such efforts is an altered state of consciousness, accompanied by deeply relaxing and pleasant feelings, all of which are associated with lower levels of stress (Gamaiunova, Brandt, Bondolfi, & Kliegel, 2019; Gotink et al., 2016; Hoge et al., 2018).

meditation technique designed to turn one's consciousness away from the outer world toward one's inner cues and awareness.

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Meditation and mental well-being **Various types of meditation go back long before it became of interest to psychologists and the focus of research.**

Meditation is an ancient practice that can be traced through the history of all the world's

major religions. Pictorial evidence of what appears to be people in meditative postures have been found on ancient walls dating back to between 5,000 and 3,500 years BCE (Possehl, 2003). Perhaps the best-known practices derive from the yoga traditions of the Hindu religion and from the Zen traditions of Buddhism. Psychologists have become quite interested in the features of various meditative techniques. These techniques all seem to include versions of self-regulation practices that involve training attention and awareness to bring our mental processes under greater voluntary control (Dahl, Lutz, & Davidson, 2015). When practised, they seem to be able to positively influence mental wellbeing and/or impact specific capacities such as calm, clarity, and concentration (Shaner, Kelly, Rockwell, & Curtis, 2017).

Two major meditation techniques seem to use opposite approaches. In *opening-up* approaches, meditators seek to clear their mind to receive new experiences. One opening-up technique is to imagine oneself as another person; a related opening-up technique involves the performance of a common task in a slightly different way, designed to call better attention to one's daily routine. In the other kind of meditation approach, *concentrative meditation*, people actively concentrate on an object, word, phrase, or idea, called a *mantra*. Concentrating upon or repeating a mantra serves to calm and focus the mind and, perhaps, clear your mind completely.

One of meditation's greatest secular appeals is that it can help people relax (Brown et al., 2010; Scotland-Coogan & Davis, 2016). In fact, studies have shown that people in meditative states experience brainwave patterns that are similar to the relaxation phase many individuals experience before falling asleep.) (Kaur & Singh, 2015). More recent work by Christina Lavalee at Laurentian University suggests that this sleeplike type of relaxation effect may be most pronounced in novice meditators, and that experienced meditators may not show the same pattern but rather seem to relax without becoming sleepy while meditating (Lavallee, Koren, & Persinger, 2011).

Researchers have found that meditation also can lower respiration, heart rate, blood pressure, and muscle tension. Because of its positive impact on physical functioning, it has been used to help treat pain, asthma, high blood pressure, heart problems, skin disorders, diabetes, and infections, and can reduce stress and anxiety (Black & Slavich, 2016; Gregoski et al., 2011; Hilton et al., 2017; la Cour & Petersen, 2015). One form of meditation that has been applied in particular to patients suffering from severe pain is *mindfulness meditation* (Labbé, 2011; Zeidan & Vago, 2016). Here, meditators pay attention to the feelings, thoughts, and sensations that are flowing through their minds during meditation, but they do so with detachment and without judgment. By being mindful but not judgmental of their feelings and thoughts, including feelings of pain, the individuals are less inclined to label or fixate on them and, in turn, are less likely to react negatively to them. Being mindful or being in the moment can help us look past distractors and focus on the tasks immediately at hand. For example, in a recent study of psychology students, meditation before listening to a lecture improved test performance after the lecture (Ramsburg & Youmans, 2014). Meditation has also been shown to reduce stress and improve mood among post-secondary students (Spadaro & Hunker, 2016). It may be worth giving it a try!

Lashing Out

As stressors pile up, people often say that they feel "as if they're going to explode." Thus, it

is not surprising that some individuals do in fact explode—psychologically or physically. They react to stress by lashing out at other people with angry words or behaviours (see Psychology Around Us 14.2). Around one-quarter of adults report such reactions (Williams & Nida, 2011).

Lashing out often occurs after a series of stressors has taken place. The particular event that triggers an aggressive outburst may seem relatively mild in itself, but for the individual under siege, it is the last straw. Recall how Ashley, the beleaguered student in our case opener, blew up at her boyfriend, Jason, during a phone conversation, calling him names and hanging up on him. Jason's crime? He had refused to let her off the phone. Ordinarily, this teasing might not have elicited such a strong reaction. But Ashley was feeling pressure from her boss, her parents, and the demands of her schoolwork. Ashley's explosive reaction isn't surprising when we consider the cumulative impact of these multiple stressors.

Everyone is capable of lashing out at others in the face of stress. For most people, it is an occasional and temporary reaction, performed before they have time to think about things and decide how to act more constructively. For some people, however, lashing out is a characteristic mode of coping. Recall that Ashley had been in the habit of lashing out at Jason. These outbursts were, in fact, a key reason that Jason decided to break up with her.

Angry outbursts, although sometimes understandable, are not typically a constructive way of dealing with stress. Such outbursts may harm relationships, produce psychological or physical damage, and lead to additional stress. Theorists and clinicians once believed that expressions of anger were cathartic, or cleansing—that is, if people expressed their anger and "got their frustrations out of their system," they would feel better and be able to move forward constructively. It turns out, however, that excessive or continuous expressions of anger usually cause further outbursts (Tavris, 2003, 1989). In one study, experimenters induced anger in participants and then directed one group of angry participants to hit a punching bag and the other group of angry individuals to sit quietly (Bushman, Baumeister, & Stack, 1999). Later in the experiment, the "punching bag" participants were found to behave much more aggressively than the "sit quiet" individuals. Similarly, angry participants in another study were attracted to violent video games (Bushman & Whitaker, 2010).

14.2 Psychology Around Us

Cursed Response

Want a quick relief from stress? Angry outbursts may not work, but apparently shouting out your favourite curse word can help. Richard Stephens and his research group at Keele University in England had college students put their arms in a bucket of ice water for as long as they could (Stephens, Atkins, & Kingston, 2009). Some of the participants were instructed to shout out curse words of their choosing while holding their arms in the water; others shouted out neutral words only. Which participants do you think were better able to keep their arms immersed in the ice water? That's right: the swearers. In fact, they kept their arms in the water almost a minute longer than the students who repeated neutral words again and again. The effect was strongest for people with lower daily swearing frequencies who do not swear very often (Stephens

& Umland, 2011). Why does swearing help? The experimenters theorized that it triggers our fight-or-flight responses, which help us deal with immediate stress and negate the link between fear of pain and pain perception. But be forewarned (or relieved)—swearing has a much greater coping and pain-reduction effect for occasional swearers than for habitual swearers.

In the long term, lashing out can harm or destroy a person's social support network, as in the example of Ashley and Jason. As mentioned earlier, social support is a primary defence against stress (see Practically Speaking 14.1). By driving away those who could help with stress-related problems, such as anxiety and depression, a person will likely make those problems worse. Perhaps one way to avoid harm to your social network would be to see if you can find one of the anger room businesses that are popping up (see photo). For a price, they provide people with opportunities to put on protective clothing and smash a bunch of random or personally chosen objects with a bat or a hammer.

Mirrorpix/Splash News Newscom

Anger room **Anger rooms or rage rooms are popping up in many cities. While some research on venting suggests it may make things worse, the fact that anger and rage room businesses seem to be thriving suggests that more research may be needed.**

Venting one's anger online is a more contemporary method of possible stress reduction. We don't know yet what the long-term effects of this behaviour are, but individuals who post negative feelings online report a reduction in perceived stress (Wendorf & Yang, 2015). This is also true for smart phone use. While excessive smart phone use can be correlated to an increase in perceived stress by the user, those who use their smart phones to communicate how they are feeling also report a reduction in stress (Karsay, Schmuck, Matthes, & Stevic, 2019).

Self-Defence

In some instances, people run away from—that is, physically leave—stressors through such

actions as dropping a difficult class, changing jobs, or ending a troubled relationship. More commonly, people try to make a "psychological getaway." Considering a complex detailed scholarship application may cause some students to decide not to complete the application and think "they probably don't give out very many of the awards." The student's behaviour in this story is an example of *reaction formation*—saying or doing the opposite of what one actually believes—one of Freud's defence mechanisms.

14.1 Practically Speaking

How Can You Manage Stress?

Europics/Newscom

Mass relaxation **A group of mostly white-collar workers in Changsha, China, receive stress relief training to help them learn to relax and survive the new fast-paced work environment.**

Stress is often unavoidable. The traffic jams, life changes, and occasional natural disasters that create stress are not going to miraculously disappear. The issue, then, is how to handle stress. Is there a way to lessen its impact so that cortisol levels, blood pressure, and the like do not soar? The answer, according to many psychologists and studies, is yes (Folkman & Moskowitz, 2004). As this chapter has already begun to suggest, there are quite a few things you can do the next time you anticipate or begin to feel the heart-pounding symptoms of stress.

Exercise, Meditation, and Relaxation

One of the best ways to manage physiological responses to stress is to exercise (Fetzner & Asmundson, 2015; Riley & Park, 2015). In fact, it appears that people who exercise regularly reap not only physical benefits, such as lowering the activity of stress hormones (Beserra et al., 2018; Kennedy et al., 2017), but also psychological benefits, such as increased self-confidence. Similarly, research indicates that some of

those who learn to quiet their thoughts and relax their muscles through meditation and relaxation training experience reductions in stress hormone activity, blood pressure, and anxiety levels (Cardoso, Souza, & Camano, 2009; Stetter & Kupper, 2002).

Social Support

Seeking the support of others, whether in the form of assistance or a sympathetic ear, is another way to ease the effects of stress. Simply knowing that friends or family will be available when needed is a form of social support (Engert et al., 2017; Sippel et al., 2015; Stein & Smith, 2015). It appears that social support helps ease the effects of stress in at least two ways—by helping to reduce the actual number and impact of threatening situations, and by providing practical, problem-focused assistance when stress does occur.

Self-Disclosure

Self-disclosure, the sharing of emotions and experiences with others in person or online, can also help people deal with stress. Up to a point, self-disclosure serves to release stress—consider the phrase "getting things off my chest"—but it is more than simply the venting of emotion. It helps people to channel emotions into a cohesive narrative, making stressors easier to process and deal with (Zhang, 2017; Zhang & Fu, 2020). In addition, by putting fearful, angry, or uncomfortable feelings into language and discussing them with other people, individuals are forced to think about and perhaps better address those feelings. Of course, the effectiveness of self-disclosure is tied to the ability of others to understand the problems a person is going through. Sexual assault victims or former prisoners of war, for example, may discover that certain relatives or friends simply cannot comprehend what they are going through. In such cases, the feedback they receive may need to be facilitated by a therapist to avoid causing more pain to the person who has experienced the trauma (Stein, Lahav, & Solomon, 2017).

Although everyone reacts to stressors with defensive behaviours on occasion, some people use such behaviours regularly. In fact, some people display what theorists describe as a *repressive coping style* (Erskine et al., 2016). They consistently deny negative feelings and discomfort and try to push such emotions out of awareness.

Is the use of defence mechanisms—whether occasional or continual—a helpful way to cope with stress? Sometimes, it probably is. We can all think of instances when it would be best to simply put something out of our mind, particularly if we don't have any control over the outcome (for example, waiting for our grade on a recent exam). Interestingly, this style of coping is used more as people get older, often to the benefit of their psychological well-being (Erskine et al., 2016) In other instances, however, defensive coping is not constructive. After all, while we spend our time defending and avoiding, the problem typically continues. The conflict with a roommate, the course paper that needs writing, and the medical problem that needs attention continue as stressors, and may even intensify.

It is also worth noting that defensive coping as a way to reduce stress can be difficult to achieve. In a classic study by Brown and colleagues (1996) they found that participants with a repressive coping style reported feeling less stress than other participants did when watching a disturbing movie but their autonomic responses were actually higher (for example, their heart rates and blood pressure were higher throughout the film). It may be that repressive coping behaviours *mask* stress rather than eliminate it. Or perhaps the higher autonomic activity associated with repressive coping indicates that such repression requires considerable physical effort. Either way, it is not surprising that people with this coping style have been found to experience more medical problems than do people who use other coping styles (Howard, Myers, & Hughes, 2017; Mund & Mitte, 2012; Myers, 2010).

Self-Indulgence

Many individuals use self-indulgent strategies, such as overeating, smoking cigarettes, and consuming drugs and alcohol, to cope with stress (Sirois & Pychyl, 2016). (See photo.) Ashley went partying with her friends, for example, to deal with the stress created by her paper-writing assignment. Such strategies may help people feel better in the short term, but in most instances they fail to change the challenge at hand and so have little long-term benefit. In fact, such responses are often associated with poor adjustment and depression and anxiety (Cooper et al., 2016; Folkman & Moskowitz, 2004; Moitra, Christopher, Anderson, & Stein, 2015).

shurkin_son/Shutterstock.com

Food and stress **Eating treats and comfort foods are less optimal ways of responding to stress.**

If the problem at hand is transient and simple—recovering from a drive home in a blinding snowstorm, for example—the self-indulgence of having a bowl of ice cream or a beer may indeed help a stressed person to calm down. If, however, the problem is more complex—such as a term paper due next week—self-indulgence is unlikely to be an effective coping strategy. Eating, drinking, shopping, watching television, or surfing the Internet will not make the problem go away. In fact, it may produce still greater pressure and higher stress:

while one indulges, the paper's due date keeps getting closer. Moreover, certain self-indulgent strategies, such as cigarette smoking, excessive alcohol consumption, drug use, and extreme overeating, have serious health effects (Mauro, Canham, Martins, & Spira, 2015; Tryon, DeCant, & Laugero, 2013; Zvauya et al., 2017).

Constructive Strategies

It is possible, of course, to cope with stress constructively rather than lashing out at others or engaging in self-defence or self-indulgence. Psychologists Richard Lazarus and Susan Folkman (1984) suggested the use of the terms *problem-focused coping* and *emotion-focused coping* to distinguish between two kinds of constructive strategies. Which of these strategies we are likely to use depends in part on the nature of the problem. For example, we could try to hit the highway at 4:00 a.m. as a way of dealing with morning traffic, but it is probably more practical to learn how to react calmly and philosophically to rush-hour tie-ups. Conversely, when a tornado watch is posted, figuring out how to calm down may not be as fruitful as deciding whether to head for the cellar or for higher ground.

In **problem-focused coping**, the person's efforts are aimed at dealing directly with the stressor in some way. For example, the late-to-work Ashley might ask her boss to assign her to a different work shift so that she has more time to get to work, or she might look for a new job closer to campus. She might devise a plan to buy a car so that she can save time travelling to work, or she might decide that her earlier solution of jogging to work is worth continuing. In any case, by being proactive and conscientious in dealing directly with the stressor, she can begin to reduce its effects (Bartley & Roesch, 2011; Chao, 2011).

> **problem-focused coping** coping strategies focused on dealing directly with the stressor, such as by changing the stressor in some way.

But what about the noisy 2-year-old next door who keeps interrupting your efforts to relax in the backyard? Or the grief we experience resulting from the death of a loved one? These are not stressors that readily yield to a problem-focused approach. When we can exert little control over stressors, we may instead try to change how we feel toward the stressors, thus limiting their negative effects—an approach Lazarus and Folkman call **emotion-focused coping**.

> **emotion-focused coping** coping strategies focused on changing one's feelings about the stressor.

In some cases, emotion-focused coping may involve *cognitive reappraisal*—finding a way to reinterpret the negative aspects of an uncontrollable situation so that they are less upsetting (Skinner & Zimmer-Gembeck, 2016; Troy, Wilhelm, Shallcross, & Mauss, 2010; Troy, Shallcross, & Mauss, 2013). People who are trying to come to terms with the death of a loved one or with some other catastrophic loss often look for ways to find positive meaning or purpose in their loss (Folkman & Moskowitz, 2004). Similarly, people may reinterpret threatening situations as challenges or tests, rather than catastrophes. The loss of a job, for example, might be viewed as a new beginning or new opportunity (Folkman & Moskowitz, 2000a, 2000b).

Changing how we think or feel about a stressor can also be a useful tactic for less traumatic stressors, such as tests and traffic jams. Rather than becoming increasingly upset over a traffic jam, for example, you may be able to shrug it off—saying, in effect, "It won't be great if I'm late, but I'll survive."

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

11. What are the main benefits of altering consciousness through meditation?

12. How can lashing out negatively affect our management of stressors?

13. What is a repressive coping style?

14. Identify and describe two forms of constructive coping.

What Do You Think? • Do you tend to use constructive coping strategies, or do your responses tend to be more maladaptive? Do you adapt your coping style to the situation, or do you tend to use the same style across many different situations? How could you improve your coping style?

Stress and Health

LEARNING OBJECTIVE 4

Explain how stress can cause physical illness, and discuss situations in which stress may be beneficial.

We have seen that stress has a profound effect on bodily functioning. Thus, it should come as no surprise that researchers have found strong relationships between stress and health—or, more accurately, between stress and illness (Groer, Meagher, & Kendall-Tackett, 2010). Scientists' appreciation of this relationship unfolded slowly. Back in the 1930s and 1940s, researchers began to recognize that certain medical illnesses are caused by an interaction of psychological factors (particularly stress-related factors) and biological factors, rather than by biological factors alone. These special illnesses were given the label *psychosomatic* or *psychophysiological diseases.* By the 1960s, a number of medical illnesses were considered psychosomatic diseases. Among the most prominent were ulcers, asthma, tension and migraine headaches, and hypertension (Ramadan, 2000; Rice, 2012; Murison, 2001; Sriram & Silverman, 1998). Although peptic ulcers have since been shown to be bacterial in nature (Marshall, 1994), stress is known to weaken the immune response and thereby increase vulnerability to the development of ulcers (Segerstrom & Miller, 2004).

Maverick/Dreamstime/GetStock.com

Road warrior **Stressful situations such as driving can contribute to a host of medical illnesses.**

As the list of psychosomatic diseases grew, medical researchers began to suspect that stress might, in fact, be at work in a wide range of medical illnesses, not just in a special few (see Psychology@Work video on Occupational Health and Safety). Their suspicions changed to near certainty when studies revealed that stress often contributes to coronary heart disease (the second-leading cause of death, after cancer, in Canada). Researchers continue to investigate how stress is connected to various illnesses, as well as how stress brings about its effects on body systems (see photo).

Coronary Heart Disease

Coronary heart disease involves a blocking of the coronary arteries—the blood vessels that surround the heart and are responsible for carrying oxygen to the heart muscle. The term actually refers to several problems, including blockage of the coronary arteries and *myocardial infarction* ("heart attack"). Together, such problems are the second-leading cause of death after cancer in men and women over the age of 45 in Canada, accounting for close to 50,000 or 20 percent of the deaths each year (Statistics Canada, 2017). Research has shown that most cases of coronary heart disease are related to an interaction of psychological factors, such as job stress, and physiological factors, such as high cholesterol, obesity, hypertension, smoking, and lack of exercise (Bekkouche et al., 2011; Kendall-Tackett, 2010; Statistics Canada, 2017).

14.1 Your Brain and Behaviour

Stressing Out when Speaking in Public

If you are like most people, you feel stressed out when you have to give a speech in

public. What is happening in the brain while you are feeling this pressure? Although you are not in physical danger, your brain is responding to the presence of an audience as if you were. Brain signals activate the sympathetic nervous system (Selye's alarm stage)—resulting in increased heart rate, sweaty palms, and a dry mouth. In the brainstem, the locus coeruleus increases arousal by changing activity in its widespread projections throughout the brain. The amygdala and cortex process sensory stimuli that in turn activate stress systems. The hypothalamus sends signals to the pituitary gland to release a hormone that stimulates the adrenal glands (located on top of your kidneys) to release cortisol, the main stress hormone. This hormone helps to mobilize energy stores so that you can cope with the stressor. Finally, the hippocampus and prefrontal cortex recognize elevated levels of cortisol and send inhibitory signals to the hypothalamus to shut down the stress response. How can you deal with this? Jeremy Jamieson has a solution called reappraisal. Jamieson and his colleagues taught stressed students how to view the physiological experience of anticipatory stress prior to public speaking in positive terms and that helped them to feel less stressed and to perform better when they stood up and spoke in public (Jamieson, 2013; Jamieson et al., 2016; Jamieson, Mendea, & Nock, 2012).

Questions

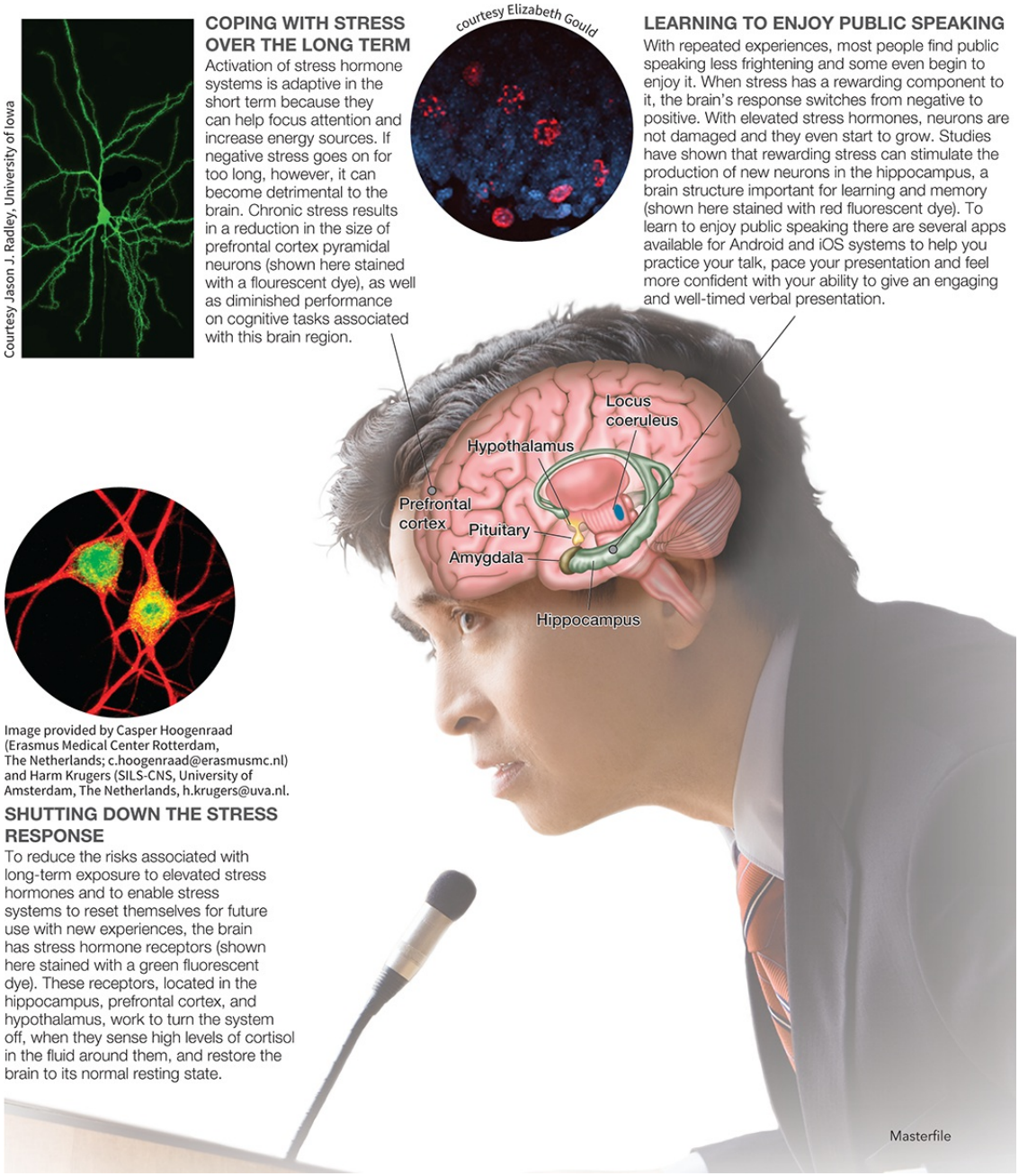
What is the role of the hypothalamus in responding to a stressor?

What does it mean to say that the effects of stress on the brain are helpful in the short term but can be harmful in the long term?

How does the brain response differ when a stressor is rewarding versus not rewarding?

Where in the brain are the stress hormone receptors that help to restore the brain to its normal state once the stressor has passed?

Fuse/Getty Images



Earlier, we discussed the Type A personality, which was identified by two cardiologists, Friedman and Rosenman. These doctors argued that the stress-producing behaviour of people with Type A personalities makes them more likely to develop coronary heart disease (see **Figure 14.5**). In fact, the Type A personality is also known in many circles as the *coronary-prone personality*. People with the more relaxed Type B behaviour pattern exhibit lower levels of stress and less coronary disease. In a pioneering study of more than 3,000 men, Friedman and Rosenman (1974) separated healthy men in their 40s and 50s into Type A and Type B groups and then followed their health over a period of eight years. The doctors found that more than twice as many of the Type A men developed coronary heart disease. Subsequent studies found similar correlations among women (Haynes,

Feinleib, & Kannel, 1980).

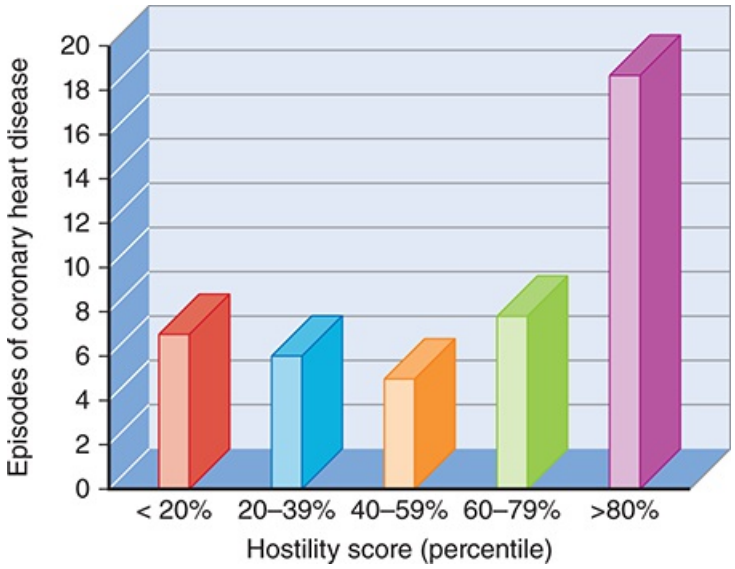


FIGURE 14.5 Type A personality and hostility A key characteristic of the Type A personality is chronic hostility. People with this personality style interact with others in a way that produces continual high levels of stress and increases their risk of coronary heart disease.

Source: Adapted from Niaura, R., et al. (2002). Hostility, the metabolic syndrome, and incident coronary heart disease. *Health Psychology*, 21, 588–593.

As research continued into the link between Type A behaviour and coronary heart disease, many investigators found that while a connection existed, it was weaker than that reported by Friedman and Rosenman (Gallacher et al., 2003). It now appears that only some of the Type A characteristics are strongly related to heart disease (Ben-Zur, 2002; Krantz & McCeney, 2002). In particular, research has identified the importance of negative emotions. Hostility, which includes not just feelings of anger but also enduring cognitive patterns of mistrust and cynicism, seems to be especially important (Smith & Gallo, 2001). (See photo.) People who score high on measures of hostility tend to experience greater stress and to have an increased risk of developing coronary heart disease, as well as other serious medical illnesses (Elovainio et al., 2011; Kendall-Tacket, 2010). More recent research has begun to suggest that aspects of Type D personalities (gloominess and social inhibition), discussed earlier in this chapter, may contribute to levels of coronary heart disease both directly (physiologically) and indirectly, through lower levels of social support (Ginting et al., 2016; Kupper & Denollet, 2018).

undergroundw/iStockphoto.com

Hostility and your heart **It is not surprising that individuals who score high on measures of hostility experience more stress and are at higher risk for heart attacks.**

Stress and the Immune System

Research clearly shows that stress can result in various medical disorders. But exactly how does this effect come about? What is it about stress that makes it a threat to health? An area of study called **psychoneuroimmunology** has tried to answer this question by examining the links between stress, the immune system, and health (Glaser & Kiecolt-Glaser, 2014; Kendall-Tackett, 2014, 2010).

> **psychoneuroimmunology** an area of study focusing on links between stress, the immune system, and health.

The **immune system** is the body's system of organs, tissues, and cells that identify and destroy foreign invaders, such as bacteria and viruses, and in some cases cancer cells. An important group of cells in the immune system are **lymphocytes**, white blood cells that circulate through the lymphatic system and the bloodstream. When stimulated by bacterial or viral invaders, lymphocytes act to help the body fight the invaders, often by destroying body cells that have been infected by the invaders.

> **immune system** the body's system of organs, tissues, and cells that identify and destroy foreign invaders, such as bacteria and viruses, as well as cancer cells.
>
> **lymphocytes** white blood cells that circulate through the body and destroy foreign invaders and cancer cells; important components of the immune system.

Researchers believe that severe stress can negatively affect the activity of lymphocytes, slowing them down and thus reducing a person's ability to fight off viral and bacterial infections (see **Figure 14.6**) (Dhabhar, 2011; Glaser & Kiecolt-Glaser, 2014). In a pioneering study, Roger Bartrop and his colleagues (1977) in New South Wales, Australia,

compared the immune systems of 26 people whose spouses had died 8 weeks earlier with those of 26 similar participants whose spouses had not died. Blood samples showed that lymphocyte functioning was significantly slower in the bereaved people than in the non-bereaved individuals (Bartrop et al., 1977). Recent work has confirmed this finding by comparing the health of spouses who care for partners with dementia. Health declines during the last stages of care but rebounds in the weeks after the death of the ill spouse. This effect, however, is tempered by the social system around the surviving spouse. The individuals who were socially isolated reported worse health than those with social support (Wilson et al., 2020). Similarly, other studies have shown poor immune system functioning in persons who are exposed to long-term social stressors, (Brodaty & Seeher, 2017; Glaser & Kiecolt-Glaser, 2014; Lovell, Moss, & Wetherell, 2011).

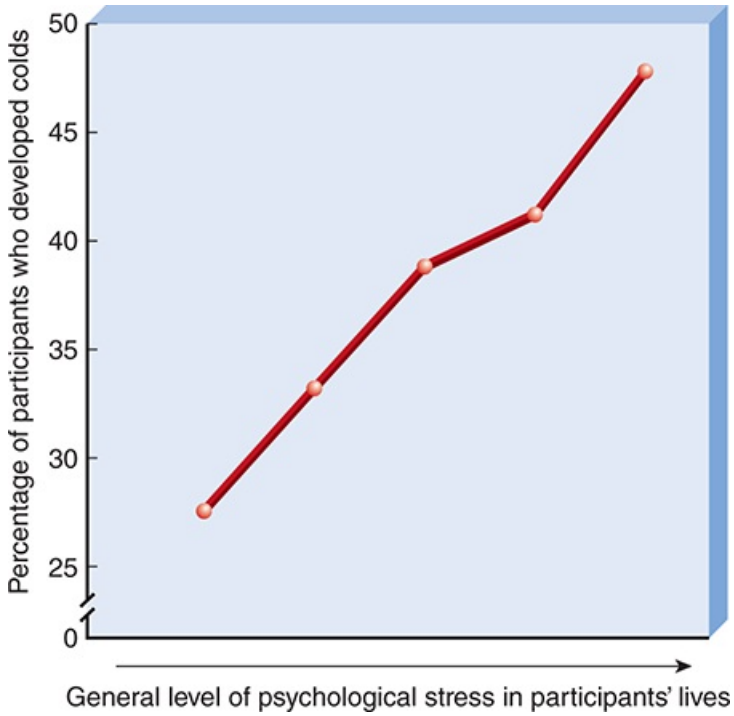


FIGURE 14.6 Stress and the common cold Researchers have examined the links between stress and illness. One study found that when healthy inoculation volunteers were exposed to a cold virus, those who generally reported the highest levels of stress in their lives were most likely to come down with a cold and to develop worse symptoms.

Source: Based on Cohen, S., Tyrrell, D. A. J., & Smith, A. P. (1991). Psychological stress and susceptibility to the common cold. *The New England Journal of Medicine*, 325, 609.

In short, during periods when healthy people confront unusual levels of stress, their immune systems slow down so that they become susceptible to illness. If stress adversely affects our very capacity to fight off illness, it is not surprising that Holmes and Rahe and other researchers have found a relationship between life stress and a wide range of illnesses. Several factors seem to influence whether and when stress will lead to immune system problems. A number of biochemical changes must occur for stress to have such an impact. Certain behavioural changes, personality styles, and social circumstances may also play a role (see Positive Psychology 14.2).

Biochemical Activity

Remember that when stressors first appear, the sympathetic nervous system springs into action. Its activity includes an increase in the release of norepinephrine throughout the brain and body. For example, beyond supporting the activity of the sympathetic nervous system, norepinephrine can eventually help slow the functioning of the immune system and increase the growth of infectious bacteria (Groer et al., 2010; Dhabhar, 2014; Sandrini, Algofaili, Freestone, & Yesilkaya, 2014). During periods of low stress, norepinephrine binds to particular lymphocyte receptors, and sends a message to lymphocytes to increase their activity (see photo). As stress rises and continues, however, the chemical travels to other receptors on the lymphocytes, binds to them, and gives an inhibitory message—a signal for the lymphocytes to stop their activity. Thus, the release of norepinephrine increases immune functioning at low levels of stress, but it slows down immune functioning in the face of higher and continuing stress.

14.2 Psychology Around Us | Positive Psychology

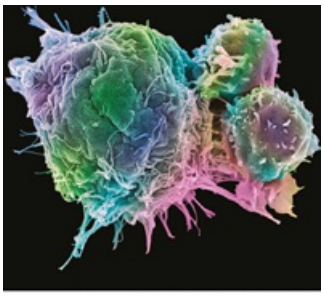
Laughter Yoga

As you've already read in the section on humour in this chapter, laughter does seem to be good for your health. Laughter as "medicine" can come in many forms and recent studies have shown that a type of yoga called laughter yoga can be beneficial in reducing circulating stress hormones (Meier et al., 2020). The practice of laughter yoga was popularized in 2002 by Madan Kataria in his book *Laugh for No Reason*. Laughter yoga uses prolonged voluntary laughter while participating in yoga breathing exercises as a strategy to reduce stress in participants. The laughter during this yoga is done for no apparent reason but practitioners have argued the brain doesn't seem to know we are faking it. While no brain imaging studies have been done comparing fake and authentic laughter, the sounds of authentic and forced laughter have been studied and are acoustically different (Lavan, Scott, & McGettigan, 2016; Ward, 2016).

Recent studies on laughter yoga report that it reduces the stress that cancer patients feel before undergoing chemotherapy and reduces stress in patients during blood dialysis. While its benefits for overall mental health are not yet clear, it does seem to hold promise for short-term reductions in anxiety and reduced depressive symptoms. It has also been reported to improve the general health of nursing students (Bennett et al., 2015; Bressington et al., 2018; Farifteh, Mohammadi-Aria, Kiamanesh, & Mofid, 2014; Yazdani, Esmaeilzadeh, Pahlavanzadeh, & Khaledi, 2014). Whether you are in poor health or not, laughter combined with yoga, at least in the short term, may be one way to get a daily or weekly bout of laughter in your busy life (Weinberg, Hammond, & Cummins, 2014).

Society Alzheimer Society

Laughter Yoga **Events such as this one where participants enjoy the combination of vigorous laughter with yoga have been held around the world over the last decade.**



Source: STEVE GSCHMEISSNER/ SCIENCE PHOTO LIBRARY/Getty Images

Internal combat **This scanning electron micrograph shows a cancer cell being attacked by natural killer T-cells, a type of lymphocyte.**

Similarly, the stress hormone cortisol lowers immune system functioning during periods of extended stress. Recall that when people are under stress, their adrenal glands release cortisol. Initially, the release of this hormone stimulates body organs into action. After stress continues for 30 minutes or more, however, the stress hormone binds to receptor sites for cortisol that are found throughout the body, and turns off the body's stress response (Gjerstad, Lightman, & Spiga, 2018). Some of these receptor sites are located on the lymphocytes. When the cortisol binds to such receptors, its inhibitory messages slow down the activity of the immune system (Groer et al., 2010; Hechter, Halkerston, & Eichorn, 2012). Again, a chemical that initially helps people to deal with stress eventually acts to slow the immune system.

Another action of cortisol is to stimulate an increase in the production of *cytokines*—proteins that bind to receptors throughout the body and play a key role in activating the immune system. During acute stress, cytokines promote the activity of the immune system and stimulate the body's ability to fight infection. But as stress continues, the ongoing production of cytokines leads to chronic inflammation throughout the body (Burg et al.,

2011; Burg & Pickering, 2011; Carlberg, Ulven, & Molnár, 2016; Kendall-Tackett, 2014). *Inflammation* is an immune response characterized by swelling, heat, redness, and pain. Chronic inflammation of this kind may contribute to the development of cancer, heart disease, stroke, and metabolic disorders such as obesity and diabetes (Coussens, Zitvogel, & Palucka, 2013; Monteiro & Azevedo, 2010). Interestingly, one of the best behavioural changes a person can make to decrease chronic inflammation, similar to decreasing stress, is to exercise (Pedersen & Saltin, 2015).

Finally, investigators have learned that patterns of immune system response vary from individual to individual (Finkel, et al., 2014). Certain individuals experience more profound immune system slowdowns in the face of stress than other individuals do. Moreover, these individual differences in immune system functioning tend to be consistent across stressful situations. Thus, some stressed persons are more likely than others to develop infections and other diseases. Let's look next at some individual factors that may be responsible for differences in immune system functioning.

Behaviour, Personality, and Social Support

Stress may trigger a series of behavioural changes that affect the immune system indirectly (Elwenspoek, Kuehn, Muller, & Turner, 2017; Murphy, Cohen, Janicki-Deverts, & Doyle, 2017). People under chronic stress may, for example, become anxious or depressed, perhaps even develop an anxiety or mood disorder. In turn, they may eat poorly, exercise less, have trouble sleeping, or smoke or drink. Such behaviours are all known to slow down the immune system (Brooks, McCabe, & Schneiderman, 2011; Glaser & Kiecolt-Glaser, 2014; Kibler, Joshi, & Hughes, 2010). In workplaces, often Occupational Health and Safety guidelines are in place to help identify and provide assistance to employees who are experiencing these sorts of stress-related problems. You can see how industrial/organizational psychologists have contributed to this important area in the Psychology@Work video on Occupational Health and Safety.

Video **PSYCHOLOGY@WORK**

Occupational Health and Safety **The video looks at how industrial/organizational psychology and research into stress and other workplace issues is addressed by occupational health and safety practitioners.**

An individual's personality may also help determine how much the immune system is affected by stress. Studies suggest that people who typically respond to life stress with optimism, effective coping, and resilience tend to experience better immune system functioning and to be better prepared to combat illness (Kendall-Tackett, 2014; Kern & Friedman, 2011; Williams et al., 2011). Correspondingly, those with "hardy" or resilient personalities tend to remain healthy after stressful events, whereas those whose personal styles are less hardy are more vulnerable to illness (Bonanno et al., 2010; Maddi, 2016).

Several studies have actually noted a relationship between certain personality characteristics and cancer (Hjerl et al., 2003). People exhibiting the Type C behaviour pattern appear to be more at risk for cancer. Recall that people with the Type C personality have trouble acknowledging negative feelings and may be particularly vulnerable to stress.

In addition, some studies have found that patients with certain forms of cancer who display a helpless or repressive coping style tend to have less successful recoveries than patients who express their emotions. It is important to note, however, that other studies have found no relationship between personality and cancer outcome (Jokela, et al., 2014). Type D personality may also be implicated both in higher cancer rates and in poorer quality of life following cancer treatment (Fleming, Wiencierz, & Williams, 2016).

A few studies have also linked spirituality to better immune system functioning. A recent meta-analysis has shown that the social support individuals with similar spiritual beliefs and practices can lead to a reduction in the circulating immune system proteins that promote inflammation. This can can lead to reduced blood pressure and better cardiovascular health. (Jackson & Bergeman, 2011; Shattuck & Muehlenbein, 2018).

Chris Arend/Getty Images

Healthy communities **This group of Inuit perform a "blanket toss" ceremony in which they form a ring around a blanket and use it to hurl group members into the air. Communities that share activities and remain close-knit often have lower illness rates than other communities.**

More generally, research indicates that social support helps to protect us from the effects of stress. People who have little social support and feel lonely, such as those with Type D personalties (Ginting et al., 2016), tend to experience poorer immune functioning when

stressed than other people do (Uchino & Birmingham, 2011; van Dooren et al., 2016). Conversely, it appears that social support helps protect people from stress, poor immune system functioning, and illness and helps improve recovery from illness or surgery (Glaser & Kiecolt-Glaser, 2014; Murphy, Cohen, Janicki-Deverts, & Doyle, 2017). Some studies have even suggested that patients with certain kinds of cancer who receive social support or supportive therapy often display better immune system functioning and, in turn, have more successful recoveries than patients without such social help.

The stress-reducing benefits of social support can be seen in the health of people who grow up in close-knit communities (see photo). One early study explored the low rate of stress-related illnesses among residents of the town of Roseto, Pennsylvania (Wolf, 1969). The death rate from coronary heart disease in this town was considerably lower than that in the general population, despite the fact that the residents' eating, smoking, and exercise patterns were similar to those in communities with much higher coronary death rates. Clearly, something special was responsible for the residents' good health. That something turned out to be Roseto's positive social environment. An Italian enclave, Roseto was home to extremely close, supportive, and traditional families. Relatives, friends, and local priests were always available to help out with any kind of problem. During the 1970s, Roseto's younger generation began to marry people from other backgrounds and move away. Church attendance also dropped. These social changes resulted in less social support throughout the community. Perhaps not surprisingly, the rate of heart attacks in the community increased (Greenberg, 1978).

The Benefits of Stress

It might be hard to believe, given the litany of problems that we have identified here, but stress can be positive. In fact, when Selye first identified stress as a concept back in 1936, he actually drew a distinction between unpleasant stressors and pleasant stressors. How can a stressor be pleasant? Think about waiting for a text from someone you met at a party last night; it can be stressful, but in an exciting way. Unpleasant stressors, according to Selye, cause **distress**—the kind of unpleasant stress on which we have generally been focusing up to now. Pleasant stressors, in contrast, cause *eustress.*

> **distress** stress caused by unpleasant situations or circumstances.

A key benefit of stress is that it helps promote positive development. Remember in Chapter 4 when we discussed some theorists' notion that parents can actually stunt a baby's development by meeting all the baby's needs, and that there is some optimal level of frustration that facilitates development? Researchers have suggested that similar principles apply across the lifespan. That is, adverse events and the stress that they produce can force you to confront challenges, adapt to your environment, and build up strength and resilience in a manner referred to as *posttraumatic growth* (Dooley et al., 2017; Tedeschi, Shakespeare-Finch, Taku, & Calhoun, 2018; Vázquez, Pérez-Sales, & Ochoa, 2014).

Today, **eustress** is defined not in terms of the stressor, but in terms of the stress level—it is the optimal level of stress that promotes physical and psychological health (Hargrove, Nelson, & Cooper, 2013; Hargrove, Becker, & Hargrove, 2015). But what exactly is an

optimal level of stress? We can think about this question in a couple of ways. First, exposing yourself to a smaller level of stress in a controlled situation can improve your performance in a more stressful situation, a process called **inoculation** (see photo). If you call one friend to talk through what you want to say to another friend with whom you have been arguing, you are inoculating yourself.

eustress the optimal level of stress needed to promote physical and psychological health.

inoculation exposing oneself to a relatively low level of stress in a controlled situation to improve later performance in a more stressful situation.

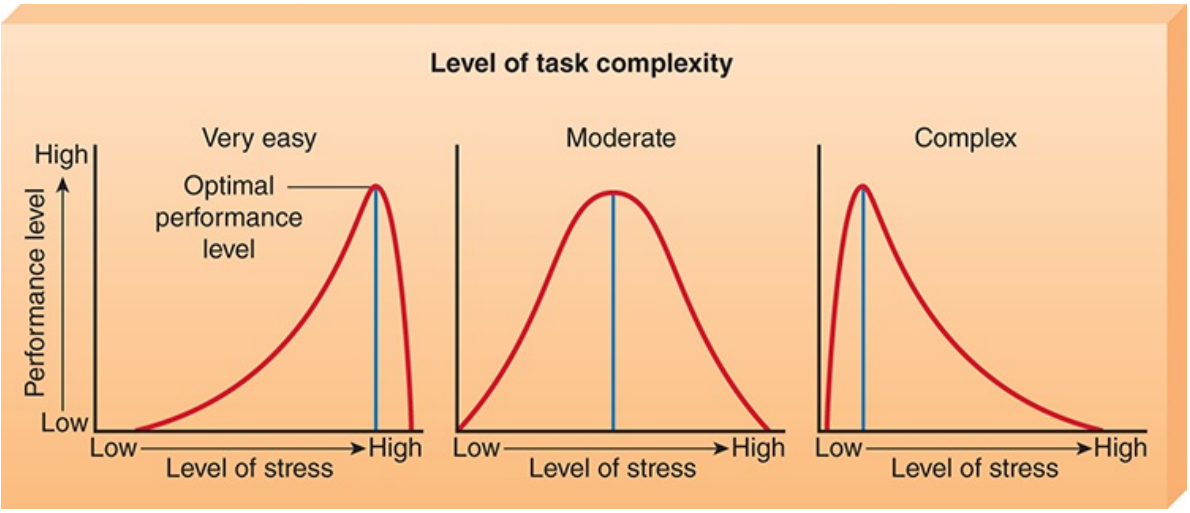


FIGURE 14.7 Stress and performance **Stress can actually benefit performance, depending on the complexity of the task. On very complex tasks, a low level of stress is optimal for performing your best; on very easy tasks, a high stress level helps you stay focused. Based on Weiten, W. (2004). *Psychology: Themes and variations* (6th ed.). Belmont, CA: Wadsworth, Figure 13.5, p. 528.**

Shannon Stapleton/Reuters - Images

Stress inoculation? Why is this drill instructor screaming at this poor recruit? The logic behind this time-honoured training technique is that intense stressors experienced during basic training will build mental strength and resilience and make individuals more effective in actual combat.

As we have seen previously, another way of considering what constitutes an optimal level of stress involves looking at the relationship between stress and performance. As shown in Figure 14.7, researchers have found that stress can actually facilitate performance on a task, depending on the complexity of the task.

Performance of very easy tasks can benefit from a high level of stress. For example, the old videogame Tetris®, which is experiencing a resurgence, involves very little cognitive complexity and very low stakes, but as the computer starts dropping the pieces faster, it will get your attention and help you stay focused on the game.

A moderately difficult task benefits from a moderate level of stress. Too low, and you won't get excited enough to perform your best. Too high, and you will be more likely to lose your focus or perform poorly.

For a complex task, low stress leads to the optimal performance. Consider that the next time you decide to make a complex dinner you have never prepared before for a few friends and don't leave quite enough time to get your house cleaned and everything prepared before they arrive. You might do better ordering out.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

15. How has stress been linked with coronary heart disease?

16. What is the connection between life changes and illness?

17. How does stress affect the immune system?

18. What factors influence whether stress will have this effect?

19. What are some beneficial effects of stress?

What Do You Think? • Try to recall five events in your life or in the lives of your family members and friends that suggest a relationship between stress and illness. How might you account for those events and relationships?

Posttraumatic Stress Disorder

LEARNING OBJECTIVE 5

Describe the symptoms and causes of posttraumatic stress disorder, and discuss some risk factors for developing it.

As we have seen, stress, when moderate and handled constructively, can serve us well. But it can also work against us. In addition to leading to physical diseases, it can contribute to various psychological disorders, from depression to sexual dysfunctions. Moreover, it plays a central role in *posttraumatic stress disorder*, or *PTSD*, mentioned earlier in the chapter.

Wolfgang Rattay/Reuters - Images

PTSD Survivors mourn the dozens of teenagers and young adults killed by a lone gunman on July 22, 2011, at Utoeya, a youth camp for Norway's Labour Party.

In posttraumatic stress disorder, persons who have confronted an extraordinarily stressful event—combat, sexual assault, earthquake, airplane crash, automobile accident, terrorist

attack, or pandemic—experience a number of severe psychological symptoms lasting for months or even years (Shiromani, Keane, & LeDoux, 2014). They have lingering reactions of intense fear and helplessness. They may be battered by memories, dreams, or nightmares connected to the traumatic event, and may repeatedly try to avoid activities, thoughts, feelings, or conversations that remind them of the event. Many also feel detached from other people, some lose interest in activities that once brought enjoyment, and some feel dazed. A number of individuals with the disorder are easily startled, develop sleep problems, and have trouble concentrating. They may also feel extreme guilt because they survived the traumatic event while others did not (Shiromani et al., 2014). (See photo.)

While any traumatic event can trigger PTSD, certain events are particularly likely to do so. The most common causes of PTSD are combat, natural disasters, abuse, and victimization (Shiromani et al., 2014). As well, people who are victims of terrorism, or who live with the fear of terrorism, often experience posttraumatic stress symptoms (Hansen et al., 2017; Slone & Mann, 2016). Many people will forever remember the events of September 11, 2001, when hijacked airplanes crashed into the World Trade Center in New York City and damaged the Pentagon in Washington, D.C. One effect of these terrorist attacks is the lingering psychological effect on the people who were directly affected and their family members, as well as on millions of others who watched images of the disasters on their television sets throughout that day. The stressful effects of this attack, in many cases PTSD, are still felt by individuals who experienced this traumatic event (Lowell et al., 2018; Welch et al., 2016).

Who Develops PTSD?

Recent work suggests that as many as 2.5 million Canadians and 70,000 first responders (firefighters, police, emergency medical service workers) suffer from PTSD at some point in their lives (Wilson, Guliani, & Boichev, 2016). The disorder can occur at any age, even in childhood (Gutermann et al., 2016). Women appear to be more likely than men to develop PTSD (Christiansen & Hansen, 2015; Pineles, Hall, & Rasmusson, 2017).

Although anyone who experiences an unusual trauma will be affected by it, only some people develop posttraumatic stress disorder (Sayed, Iacoviello, & Charney, 2015). (See photo.) To understand the development of this disorder more fully, researchers have looked at the same stress-related factors that we have examined throughout this chapter—and they have come up with promising leads.

Biological Factors

As we have observed, stressors trigger biochemical reactions throughout the brain and body. Apparently, in the face of extraordinarily threatening stressors, some people develop particularly strong biochemical reactions—reactions that continue well beyond a short-term fight-or-flight period. It appears that such individuals are more likely than others to experience a posttraumatic stress disorder (Zoladz & Diamond, 2013; Bremner & Charney, 2010; Pace & Heim, 2011). Consistent with this notion, researchers have found abnormal activity of the stress hormone cortisol and the neurotransmitter norepinephrine in the urine and blood of combat soldiers, sexual assault victims, concentration camp survivors, and survivors of other traumatic events (Burijon, 2007; Delahanty et al., 2005; Pan et al., 2018).

STRDEL/Stringer/Getty Images

Is anyone immune? Rescuers pull a survivor from the rubble of a collapsed garment factory in Bangladesh in May 2013. Most people who experience extraordinary traumatic events are capable of developing PTSD. Even rescue workers at the site of disasters often develop the disorder. Nevertheless, all things being equal, some people seem more prone to PTSD in the aftermath of traumatic events.

Indeed, some studies suggest that people who develop PTSD have exaggerated sympathetic nervous system responses and blunted HPA axis responses to stress; however, the data is currently non-conclusive (Dunlop & Wong, 2019). There is also some evidence that once a posttraumatic stress disorder sets in, the individual's continuing biochemical arousal may eventually shrink the hippocampus, one of the brain areas that helps control the body's stress hormones, thus further locking in the disorder (Kim, Pellman, & Kim, 2015). At the same time, it is worth noting that, according to some research, people who are more susceptible to developing PTSD may have a smaller hippocampus to begin with (Greenberg et al., 2014).

Personality

Earlier, we observed that people with certain personality styles or coping styles are particularly likely to react to threats with stress and to develop medical problems. Similarly, such styles increase the likelihood of developing a posttraumatic stress disorder (Campbell, Renshaw, & Righter, 2015). It turns out, for example, that people with less resilient, or less hardy, personality styles appear more likely to develop a posttraumatic stress disorder than those with more resilient styles (Horn, Charney, & Feder, 2016; Kunst, 2011). Interestingly, the personality trait that seems to be associated with less severe PTSD-like symptoms, or greater resilience after a traumatic event, is psychological flexibility. A person's ability to adapt to changing demands in their environment, shift their perspective, and reassess and reconfigure their mental resources seem to be key personality traits for managing PTSD (Kashdan & Rottenberg, 2010; Meyer, Kotte, et al., 2019; Meyer, La Bash, et al., 2019).

Childhood Experience

Studies have also suggested that certain childhood experiences increase the risk of later posttraumatic stress disorders (Alter & Hen, 2009; Brockie et al., 2015; Rapee & Bryant, 2009). (See photo.) People whose childhoods have been characterized by poverty appear more likely to develop this disorder when later confronting horrific events. So are people whose parents displayed psychological disorders and who experienced assault, abuse, or catastrophe at a young age (Gutermann et al., 2016).

Chris Hondros/Getty Images

Detecting PTSD in children **The Sesame Street Muppet Rosita tells children in New York about "You Can Ask," a program that seeks to identify and deal with stress in children. The program was first formed in the aftermath of the September 11, 2001 terrorist attacks.**

Social Support

Finally, the social environment may influence whether victims of traumatic events develop

posttraumatic stress disorders. Earlier, we saw that inadequate social support can intensify stress reactions and slow down immune system functioning. Thus, it is not surprising that people with strong social support systems are more likely to recover, or cope better with, a posttraumatic stress disorder after a traumatic event (than those with weak social support systems (Olff et al., 2014). (Maheux & Price, 2016; Stanley et al., 2018) For example, sexual assault victims who feel loved, cared for, and accepted by their friends and relatives tend to recover more successfully (Dworkin et al., 2018; Ullman & Peter-Hagene, 2016).

We will look at posttraumatic stress disorder in greater detail in Chapter 15. In the meantime, the current discussion helps clarify once again that stress is a very powerful force. Moreover, when it is overwhelming or dealt with ineffectively, it can totally disrupt our functioning and our lives.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

20. What are some symptoms of posttraumatic stress disorder?

21. What factors put a person at heightened risk for developing posttraumatic stress disorder following a traumatic event?

What Do You Think? • Try to recall five events in your life or in the lives of your family members and friends that suggest a relationship between stress and illness. Having now read this chapter, how might you account for those events and relationships?

Summary

What Is Stress?

LEARNING OBJECTIVE 1 Define stress and describe the ways in which people experience stress and the kinds of situations that typically cause stress.

Stress is a state brought on by any situation that threatens or appears to threaten a person's sense of well-being, thus challenging the person's ability to cope. A situation that triggers the stress response is a stressor. A stressor may be acute (short term) or chronic (long term).

People may experience stress as frustration, pressure, conflict, or danger.

Kinds of stressors include daily hassles, life changes (which can be measured by the Social Readjustment Rating Scale), traumatic events, chronic negative situations, and special socio-cultural conditions.

Responding to Stress

LEARNING OBJECTIVE 2 Describe the physiological, emotional, and cognitive responses to stress, and explain how individual responses to stress differ.

There are two main physiological pathways of stress: the sympathetic nervous system and the hypothalamic-pituitary-adrenal axis. Both lead to activation of the fight-or-flight response, which is an immediate response to a stressor.

Hans Selye first described the effects of chronic stress, which he called the general adaptation syndrome (GAS). The syndrome has three stages: alarm, resistance, and exhaustion.

Emotional responses to stress generally involve negative emotions. The more stress a person experiences, the more negative the emotions.

Cognitive appraisal is an important element in responses to stress. Richard Lazarus identified two steps in this process: *primary appraisal*, in which people assess the severity of the stressor, and *secondary appraisal*, in which they evaluate how well they can cope with it.

Individuals vary greatly in their responses to stress. Areas of difference include autonomic activity, explanatory style, personality, and availability of social support.

Coping with Stress

LEARNING OBJECTIVE 3 Discuss and evaluate several ways in which people cope with stress.

Coping describes efforts to manage, reduce, or tolerate stress.

Dealing with stress by lashing out at others, using defence mechanisms such as repression, and engaging in self-indulgent behaviours such as smoking or drinking alcohol can be destructive when used in excess.

More constructive coping strategies include directly confronting a stressor in hopes of changing the situation (*problem-focused coping*) and changing how you feel or think about the stressor to reduce its impact (*emotion-focused coping*).

Stress and Health

LEARNING OBJECTIVE 4 Explain how stress can cause physical illness, and discuss situations in which stress may be beneficial.

Stress can increase risk for a number of health problems. People with *Type A* personalities are prone to stress and appear to be at greater risk for coronary heart disease than the more relaxed *Type B* personalities. Using the Social Readjustment Rating Scale, researchers have found that stress-producing life changes also increase the risk of illness. *Type C* personalities are more vulnerable as they tend to internalize their anger and cope badly with relationship challenges. *Type D* personalities are more vulnerable because they tend to cut themselves off from social supports.

Psychoimmunology is an area of study that examines the links between stress, the immune system, and health.

Severe stress may interfere with the activity of *lymphocytes*, a component of the

immune system that helps the body to overcome invaders, such as bacteria and viruses.

Stress-related biochemical changes in the body, such as changes in the activity of norepinephrine and cortisol, can eventually slow the functioning of the immune system.

Behaviour, personality, and social support are additional factors affecting how much the immune system is slowed down by stress.

Unlike *distress*, or negative stress, *eustress* offers benefits. Optimal levels of stress can promote the development of resilience and facilitate performance, especially for easy or moderately difficult tasks.

Posttraumatic Stress Disorder

LEARNING OBJECTIVE 5 Describe the symptoms and causes of posttraumatic stress disorder, and discuss some risk factors for developing it.

Posttraumatic stress disorder is characterized by persistent, frightening thoughts or memories of a traumatic event, along with anxiety, depression, and other symptoms.

Combat, natural disasters, and abuse and victimization are among the events most likely to cause posttraumatic stress disorder.

Not everyone affected by unusual trauma develops posttraumatic stress disorder. Factors that affect the likelihood of developing the disorder include biological factors, personality factors, childhood experiences, and the availability of social support.

Key Terms

acute stressor

approach–approach conflict

approach–avoidance conflict

avoidance–avoidance conflict

chronic stressor

conflict

coping

daily hassles

distress

emotion-focused coping

eustress

frustration

general adaptation syndrome (GAS)

immune system

inoculation

life changes

lymphocytes

meditation

posttraumatic stress disorder (PTSD)

pressure

primary appraisal

problem-focused coping

psychoneuroimmunology

secondary appraisal

stress

stressor

traumatic events

Type A

Type B

Type C

Type D

Self-Study Questions

Multiple Choice

1. The sweaty palms and rapid heartbeat we experience as anxiety are most directly related to activation of which portion of the nervous system?

- **a.** Autonomic nervous system
- **b.** Hippocampus
- **c.** Occipital lobes
- **d.** Sympathetic nervous system

2. Compared with major life events, daily hassles

- **a.** have a lower impact upon us.
- **b.** can add to the effects of larger events.
- **c.** can have greater impact than the effects of major life events.
- **d.** are of secondary concern.

3. Bob loves visiting his grandfather but hates his cooking. Bob is trying to decide whether to visit his grandfather this weekend and is experiencing an

a. approach–approach conflict.

b. approach–avoidance conflict.

c. avoidance–avoidance conflict.

d. approach–withdraw conflict.

4. During concentrative meditation, a person actively concentrates on an object, word, or idea called a(n) _____.

a. dissociation

b. koan

c. mantra

d. suggestion

5. Which of the following is not potentially associated with posttraumatic stress disorder?

a. Anxiety

b. Depression

c. Amnesia

d. Disorientation

6. What does the release of cortisol during stressful experiences do for us?

a. Elevates blood sugar

b. Energizes us

c. Protects us from inflammation

d. All of the above

7. Which of the following is one experience that can lead to feeling stressed?

a. Automatic

b. Frustration

c. Happiness

d. Sensitization

8. In a study using the Social Readjustment Rating Scale, which of the following stressors was not reported as one of the top five experienced by college and university students?

a. Applying to graduate school

b. Death of a family member or friend

c. Having to take multiple tests

d. Personal injury or illness

9. Which of the following statements shows the correct order of the components of the physiological response to stress?

a. hypothalamus → adrenal cortex → pituitary

b. hypothalamus → adrenal medulla → pituitary

c. hypothalamus → pituitary → adrenal cortex

d. hypothalamus → pituitary → adrenal medulla

10. Recent research has shown that _____ is the aspect of Type A personality that is most strongly associated with coronary heart disease.

a. competitiveness

b. hostility

c. impatience

d. pessimism

11. Which type of task is best suited to moderate levels of stress?

a. Easy

b. Medium

c. Difficult

d. None of these; moderate stress is the optimal stress level for all types of tasks.

Fill-in-the-Blank

1. When we are deciding what a particular situation means to us in terms of its stress potential, we are _____ the situation.

2. If your friends were to forget to invite you to a party, it would be an example of a _____ stressor.

3. If you were to complete the Social Readjustment Rating Scale in a research project, you would be assigned a _____.

4. When a minority-group member encounters members of the majority group, they may experience _____ threat.

5. In the resistance phase of the general adaptation syndrome, our resistance level to the effects of stress is _____ relative to unstressed levels.

6. The fact that a given situation may be very stressful for one person and not at all stressful for another tells us that the _____ of threat is often more important than actual threat.

7. Emily is struggling to keep up with her classes and must choose whether to work on a paper for one class or a project for another class before heading to work. Emily is facing a(n) _____ conflict.

8. _____ meditation has been shown to relieve pain by encouraging people to pay

attention to their feelings, sensations, and experiences without judging or getting too involved with them.

9. When faced with a stressor, the nervous system communicates with the endocrine system via the _____ axis.

10. Although early research showed that having a Type A personality was related to the risk of coronary heart disease, recent studies have shown that the cluster of negative emotions called _____ is a better predictor of risk.

11. _____ is a neurotransmitter that tends to improve immune system functioning in times of low stress and impair it during periods of severe or prolonged stress.

CHAPTER 15
Psychological Disorders

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CHAPTER OUTLINE

Defining, Classifying, and Diagnosing Psychological Abnormality

LEARNING OBJECTIVE 1 Identify the common features of most definitions of abnormal functioning, and describe how psychological disorders are classified and diagnosed.

Models of Abnormality

LEARNING OBJECTIVE 2 Describe the major models used by psychologists to explain abnormal functioning.

Mood Disorders

LEARNING OBJECTIVE 3 Describe and differentiate major depressive disorder and bipolar disorder.

Anxiety Disorders

LEARNING OBJECTIVE 4 Describe the various types of anxiety disorders, and explain some causes of these disorders.

Schizophrenia

LEARNING OBJECTIVE 5 Describe the features of schizophrenia and some theories of what causes it.

Other Disorders

LEARNING OBJECTIVE 6 Discuss the features and possible causes of somatic symptom and related disorders, dissociative, and personality disorders.

Diane Markos, a 27-year-old single female, struggled with depression. Within a period of three months, she lost 7 kilograms and she felt tired all the time. She withdrew from nearly all her usual social activities and she openly acknowledged thoughts of overdosing on pills. Previous psychotherapy and treatment with antidepressant medication had produced no improvement. She was referred to a psychologist for additional treatment.

Diane's changes over the three months occurred shortly after the breakup of a relationship she had been having with a man for approximately two years. She now saw herself as fat, unattractive, and doomed to be alone. Although she had never had a wide circle of friends, the past two years had seen her social contacts become even more limited. Other than the few evenings that she spent with her boyfriend, she had gradually managed to work herself into a life of all work and no play, and she was intensely lonely.

Diane lived alone and worked full-time as a pediatric nurse while pursuing a master's degree part-time in nursing. Although she was a straight-A student, she had numerous interpersonal difficulties with fellow students and instructors. Her relations with co-workers were similarly troubled. Although she had a reputation as a good staff nurse, she had never been able to obtain a supervisory position because of her ongoing interpersonal conflicts.

Diane's early family history provided some clues to the sources of her current difficulties. As the eldest of three children, she was frequently expected to play the role of caretaker for her younger siblings. She felt that her parents' love was contingent on her playing the role of "mother's little helper." She believed that her sister and brother had been allowed to lead a much more carefree childhood.

In short, Diane saw her past and present as an unhappy life of servitude, rejection, and failure. And she could envision no other scenario for her future. She felt quite hopeless, and as a result her new therapist considered her to be a serious suicide risk (Taylor et al., 2011).

Throughout this book we have examined the nature of behaviour and mental functioning, from sensations to memory to personality. Most of our discussions have looked at "typical" functioning. And indeed, our mental life and behaviour are fascinating and complex even when they do not go astray. However, as we have repeatedly observed, functioning often does go astray. We are immediately reminded of this as we read about Diane Markos. Most who hear about Diane would likely agree that her depressed mood, isolated behaviour, and negative thinking are far from functional.

You have already come across a few of the leading psychological disorders while reading the Atypical Development sections throughout this book. In this chapter, we will be looking even more closely at the topic of abnormal psychological functioning (see paintings). First, we will see that although most people believe they know abnormal functioning when they see it, it is, in fact, a difficult concept to define. Then, we will explore the ways in which psychologists classify, assess, and explain the various kinds of abnormal functioning. In the next chapter, we will examine how mental health practitioners try to help the individuals whose behaviours, thoughts, or emotions are dysfunctional—individuals known as *clients* or *patients* when seen in mental health settings.

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Bettmann/Getty Images

Art and psychological disorders **Many of our greatest paintings focus on psychological dysfunction. Two of the most famous are *The Scream*, by Edvard Munch, which brings symptoms of anxiety and panic to life, and *Portrait of Dr. Gachet*, by Vincent van Gogh, about depression.**

Defining, Classifying, and Diagnosing Psychological Abnormality

LEARNING OBJECTIVE 1

Identify the common features of most definitions of abnormal functioning, and describe how psychological disorders are classified and diagnosed.

Diane Markos's emotions, behaviours, and thoughts appear to be atypical, the result of states sometimes referred to as *psychological dysfunctioning*, *psychopathology*, *psychological disorders*, or *mental disorders*. The field devoted to the scientific study of psychological disorders is usually called **abnormal psychology**.

abnormal psychology the scientific study of psychological disorders.

Abnormal psychological functioning is a wide-ranging problem, as indicated in **Figure 15.1**. It has been estimated that in a given year, at least 20 percent of adults in Canada experience serious psychological disturbances (Canadian Mental Health Association, 2014b) and the rate for 20- to 29-year-olds is closer to 28 percent (Mental Health

Commission of Canada, 2013). The numbers and rates in other countries are similar (Andreas et al., 2017; Steel et al., 2014; Polanczyk et al., 2015).

Furthermore, many people go through periods of great tension, upset, or other forms of psychological discomfort in their lives. At such times, they experience at least some of the distress found in psychological disorders.

What are your thoughts regarding the causes of mental illness? Throughout history, humans have speculated about the causes of the abnormal behaviours that seem to be a part of the human condition. In ancient times, there is evidence that "madness" was seen as a sign of demonic possession or of witch or warlock status. In many cases the "cures" were not particularly helpful to the individuals involved, given that they were intended to cast out evil spirits by burning or drowning. Many people did not survive their "cures." In more recent times, things were not much better for the mentally ill. A lack of understanding of the causes of mental illness led to a general belief that afflicted individuals were of inferior character, even less than human (Schwab, 2013). In the 1700s in the United Kingdom, those families that could afford it often hid their mentally ill relatives away and cared for them in isolation. Those who could not afford this had few options. Many "mad" people were left at places like Bethlehem Hospital in London, where care was minimal and the use of restraints typical. Tours through the hospital to see the mad people were a major source of revenue for the hospital (Northwood, 2014; Andrews et al., 1997).

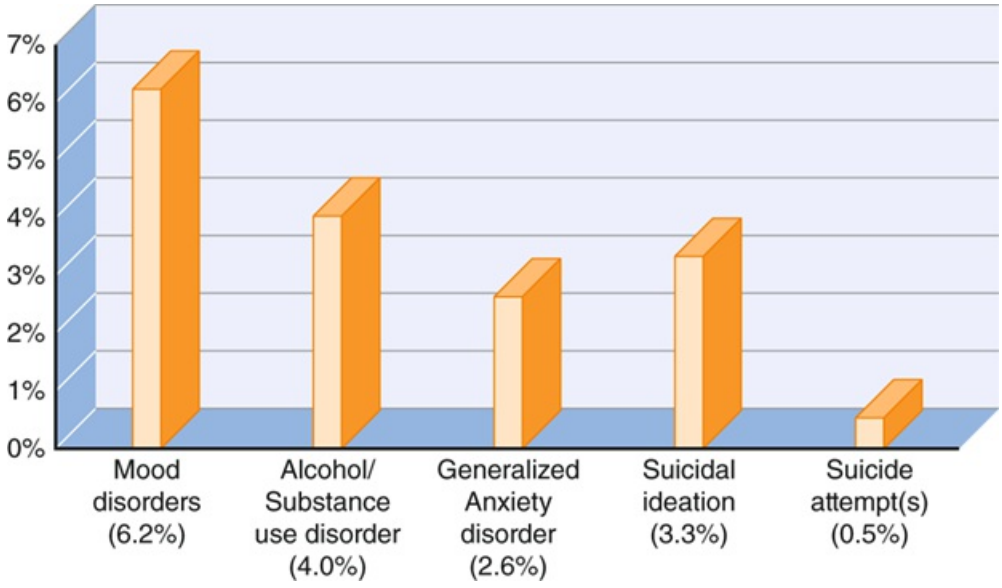

FIGURE 15.1 How many people are diagnosed with mental disorders each year? Nearly one-quarter of the adults in Canada each year experience symptoms that qualify for a diagnosis of at least one mental disorder.

Source: Palay et al. (2019). Prevalence of mental disorders and suicidality in Canadian provinces. *The Canadian Journal of Psychiatry*, *64*(11), 761–769.

While many argued for more humanitarian treatment for the mentally ill, reform movements did not really gain any ground until a clear connection was made between physical illness and madness. A condition called general paresis was well-known in medical circles (Beck & Tompkins, 2016). It usually afflicted males between 20 and 40 years of age.

Initial symptoms included memory loss (short and long term), impairment of judgment, and decreases in motivation and language. Later symptoms included delusions and hallucinations, inappropriate moods and/or anger, and eventually full-blown dementia, seizures, and death. The symptoms progressed over a few months to at most one or two years, and death was inevitable. When it was discovered that general paresis was the result of a sexually transmitted infection, syphilis, two things resulted (Brown, 2008). First, it was possible to treat syphilis and avoid general paresis; second, it clearly showed that the signs of madness could be symptoms of an underlying physical illness. This gave strong support to mental health reform movements such as *moral treatment*, which led to more humane treatment for the mentally ill (Manning, 2013; Eastoe, 2020).

Historical/Getty Images

Early interventions **Benjamin Rush, a doctor and signatory to the American constitution, developed the tranquilizing chair shown here. It was believed to calm mental patients by reducing blood flow to the head.**

The *medical model* approach to understanding and treating mental illness has been a major influence on our thinking and practices in assisting those struggling with mental illness over the past century (see illustration). The medical model encourages a search for patterns in the symptoms people present with the goal of first identifying a syndrome—a collection of symptoms, like general paresis—that is recognized and about which one can make predictions. In the case of general paresis, the predictions made about prognosis were accurate but deadly. The next step involves a search for possible causes of the observed symptoms. Hopefully the identification of underlying causes also suggests viable treatments (Huda, 2019).

As we will see later in this chapter and in the next chapter, when we look at treatment approaches, the biological basis of the medical model approach to mental illness certainly

has significant research support. We will also see, however, that there are serious concerns about the limitations of the medical model. By focusing on physical/biological causes, the medical model takes focus away from the possible roles played by psychological processes and socio-cultural circumstances on mental illness and mental health (Tyrer, 2013). In the rest of this chapter we will provide you with a sense of these broader perspectives in mental illness and mental health.

Defining Psychological Abnormality

How do we know that someone is functioning abnormally? In other words, what is psychological abnormality? This question is not easy to answer. Although many definitions of abnormality have been proposed over the years, none is universally accepted (Pilgrim, 2014). Nevertheless, most of the definitions have key features in common, often called "the four Ds": deviance, distress, dysfunction, and danger.

Deviance Behaviour, thoughts, and emotions are considered abnormal when they deviate from a society's ideas about proper functioning. Judgments of deviance and abnormality vary from society to society. A society that values competition and dominance may embrace aggressive behaviour, whereas one that emphasizes cooperation may consider such behaviour unacceptable and even abnormal (Eller, 2016). Moreover, a society's values may change over time, leading to a new societal view of what is psychologically abnormal. In Western society, for example, a woman's participation in athletics, academia, or business was considered unusual and even inappropriate 100 years ago (Matsumoto & Juang, 2016). Today, people in Western cultures value that behaviour.

Distress To be considered abnormal, behaviours, ideas, or emotions usually must also cause distress or unhappiness (Matthews, 2016). For example, Diane Markos from the opening case feels upset and burdened most of the time by her negative feelings and thoughts and the impact they are having on her life.

Dysfunction Abnormal behaviour also tends to interfere with daily functioning, as opposed to behaviour that is simply eccentric but a part of a person's life. When behaviour upsets people so that they cannot take proper care of themselves, interact well with others, or work effectively, then it is referred to as abnormal. For example, Diane's behaviours have contributed to social isolation, problems at work, and conflicts at school.

Danger Some people with psychological dysfunction are more likely to become dangerous to themselves but are less likely to harm others. If, for example, individuals are consistently hostile or confused, they may put themselves, family members, or friends at risk. Recall that Diane Markos's thoughts of overdosing on pills led her therapist to consider her a serious suicide risk. It is important to note that while the incidence of violence among the mentally ill is slightly higher than in the general population, it is often linked more directly to associated issues of substance abuse (Van Dorn et al., 2017). Despite popular views, most people who are greatly troubled or even out of touch with reality pose no immediate danger to themselves or anyone else (Reavley, Jorm, & Morgan, 2016).

AP Photo/RAJESH NIRGUDE

Does dysfunction equal abnormality? In this photo, a Tibetan man set himself on fire to protest China's occupation of Tibet. In this context, such behaviour, while self-harming, does not, by itself, indicate that he is experiencing a psychological disorder.

As our discussion suggests, the current definition of abnormality depends heavily on social norms and values (see photo). At the same time, societies often have difficulties distinguishing between an abnormality that requires help and an eccentricity that should not be the concern of other people. We often see or hear about people who behave in ways we consider strange, such as an individual who lives alone with dozens of animals and avoids other people. The behaviour of such individuals is deviant, but unless it leads to clear distress and dysfunction, most clinicians would judge it to be eccentric rather than abnormal (Bergner & Bunford, 2017).

An eccentric is a person who deviates from common behaviour patterns or displays odd or whimsical behaviour. Eccentrics do not typically suffer from psychological disorders, and eccentricity is not an absolute but a continuum. Whereas the unusual behaviour of persons with disorders is thrust upon them and usually causes them suffering, eccentricity is chosen freely and provides pleasure. In short, "Eccentrics know they're different and glory in it" (Weeks & James, 1995, p. 14).

Many well-known people were eccentrics. Hetty Green, the richest woman in the world in the late 1800s and early 1900s, always wore the same black dress and only changed her underwear when it wore out. When her son injured his leg, she disguised herself and tried to get him into a charity hospital. Once recognized, she fled with her son, claiming she would treat him herself. He later had to have the leg amputated due to gangrene. Writer

James Joyce always carried a tiny pair of lady's bloomers, which he waved in the air to show approval. Emily Dickinson always wore white, never left her room, and hid her poems in tiny boxes. Benjamin Franklin took "air baths" for his health, sitting naked in front of an open window. United States President John Quincy Adams swam nude in the Potomac River each morning. Canadian Prime Minister William Lyon Mackenzie King regularly attended séances to consult the spirits of Leonardo da Vinci, Sir Wilfrid Laurier, his mother, and several of his Irish Terrier dogs (all named Pat, with the exception of one named Bob) (Dummitt, 2017). Michelangelo, who was notoriously bad-tempered, was also known for his eccentricities: he rarely ate or bathed, slept fully dressed—including his shoes—never changed his clothes, and removed his shoes so infrequently that the skin would often peel off with the shoes. Finally, pop star Lady Gaga was once voted the world's best-loved eccentric celebrity (ABC News, 2012). (See photo.)

Barry Brecheisen/Getty Images

Eccentric? Pop star Lady Gaga said that her former eccentric style, which she recently toned down, was a form of artistic expression.

Do these behaviours constitute mental illness? Most of them probably do not. Although these behaviours disregard standards for normal behaviour, they are largely benign; that is, they are not maladaptive or dysfunctional.

Given such difficulties, how do psychologists determine which experiences constitute or do not constitute a psychological disorder, and how do they distinguish among various disorders? In large part, they rely upon *classification* and *diagnosis*.

Classifying and Diagnosing Psychological Disorders

A symptom is a physical, behavioural, or mental feature that helps indicate a condition, illness, or disorder. Fatigue is often a symptom of depression, for example. Similarly, poor concentration can be a symptom of anxiety, and hallucinations may indicate schizophrenia (Kring & Johnson, 2018; Ernst, 2006). When certain symptoms regularly occur together and follow a particular course, clinicians agree that those symptoms make up a particular mental disorder. A list of such disorders, with descriptions of the symptoms and guidelines for determining when individuals should be assigned to the categories, is known as a *classification system*.

The classification system that is used by most countries throughout the world is the ***International Classification of Diseases (ICD)***, published by the World Health Organization (WHO). The ICD is now in its 11th edition (ICD-11) (Boerma, 2017). The leading classification system in North America is the ***Diagnostic and Statistical Manual of Mental Disorders (DSM)***, published by the American Psychiatric Association. The DSM has been revised several times since it was first published in 1952. The current version is called the DSM-5 (APA, 2013). It lists and describes the symptoms of approximately 22 major categories with more than 200 mental disorders (see **Table 15.1**). Language used in the DSM-5 reflects proposed ICD-11 naming conventions and reflects the collaborative efforts made between the WHO and DSM working groups (Regier, Kuhl, & Kupfer, 2013). However, the process and development of revising the DSM was one of controversy and debate, and the latest manual has not been embraced by all professionals expected to use it. For example, a number of researchers express trepidation, arguing that although conclusive knowledge about the impact of the DSM-5 will come only with time, there are flaws with the manual's content (Wakefield, 2016; Harkness, Reynolds, & Lilienfeld, 2014; Regier et al., 2013; Stein, Lund, & Nesse, 2013). In particular, professionals express concerns about "fuzzy" constructs and narrowly depicted concepts in the DSM-5, as well as a lack of acknowledgement for many of the individual-level and societal-level causal mechanisms known to underlie mental disorders, such as abuse and poverty (Young, 2016). Others contend that the psychiatric drug industry had too strong a role in the development of the latest manual (Cosgrove et al., 2016; Cosgrove & Krimsky, 2012; Frances, 2010).

> ***International Classification of Diseases (ICD)*** the system used by most countries to classify psychological disorders; published by the World Health Organization and currently in its 11th edition (ICD-10).
>
> ***Diagnostic and Statistical Manual of Mental Disorders (DSM)*** the leading classification system for psychological disorders in Canada; DSM-5 is the current version.

When clinicians decide that a person's symptoms fit the criteria for a particular disorder, they are making a **diagnosis**. Most clinicians in Canada use the DSM to help them diagnose their clients' problems. Assigning a diagnosis suggests that the client's pattern of dysfunction is basically the same as patterns displayed by many other people who show the same types of symptoms, has been researched in numerous studies, and has responded to certain kinds of treatment. It helps to ensure that clinicians are acting in a consistent manner and that they are basing their clinical and research decisions on a set of clearly

articulated and shared criteria. Clinicians can then apply what is generally known about the disorder to the client with whom they are working (see Psychology Around Us 15.1).

> **diagnosis** a clinician's determination that a person's cluster of symptoms represents a particular disorder.

As we will see later in this chapter, based on her pattern of symptoms, Diane Markos would probably receive a diagnosis of a mood disorder: *major depressive disorder*. A clinician might also take note of the fact that Diane has avoided people and social relationships throughout her life, largely because she fears being judged, and might further assign her a diagnosis of *avoidant personality disorder*. When people qualify for two or more diagnoses, they are said to display **comorbidity**. Comorbidity refers to the co-occurrence of two or more diagnoses in one person (Sartorius, Holt, & Maj, 2015; Gadermann et al., 2012).

> **comorbidity** the condition in which a person's symptoms qualify him or her for two or more diagnoses.

TABLE 15.1

Disorders in DSM-5

Group	Description	Some Disorders Listed in This Group
Neurodevelopmental disorders	Disorders with their onset in the developmental period before the child enters grade school; usually involve impairments in personal, social, or academic functioning	intellectual disability language disorder autism spectrum disorder specific learning disorder
Neurocognitive disorders	Disorders where the primary clinical deficit is cognitive function. The deficit is acquired in that it reflects a decrease from a previous state of functioning, as in the case of Alzheimer's disease	delirium major and mild neurocognitive disorders major or mild neurocognitive disorder due to traumatic brain injury
Substance-related and addictive disorders	Disorders that involve the activation of reward pathways and reward systems due to substance use or induced by substances; also includes gambling disorder	alcohol use disorder caffeine intoxication opioid use disorder stimulant use disorder

Schizophrenia-spectrum and other psychotic disorders	Disorders defined by abnormalities in the form of delusions, disordered thoughts or behaviours, or negative symptoms such as avolition (lack of motivation) or loss of communication ability	delusional disorder schizophrenia schizoaffective disorder
Depressive disorders	The presence of sad, empty, or irritable mood that typically goes along with physical or cognitive changes	major depressive disorder premenstrual dysphoric disorder disruptive mood dysregulation disorder
Bipolar and related disorders	Alternating bouts of intense positive affect that are followed or preceded by prolonged periods of sadness and other symptoms of depression; seen as a bridge between depressive disorders and disorders representing the schizophrenia spectrum	bipolar I disorder bipolar II disorder cyclothymic disorder
Anxiety disorders	Disorders that share features of excessive fear or anxiety and related behavioural disturbances	specific phobia social anxiety disorder generalized anxiety disorder panic disorder
Obsessive-compulsive and related disorders	Disorders characterized by repetitive thoughts or behavioural rituals	obsessive-compulsive disorder body dysmorphic disorder hoarding disorder
Trauma and stressor-related disorders	Disorders that reflect exposure to a distressing event or events	posttraumatic stress disorder acute stress disorder reactive attachment disorder
Somatic symptoms and related disorders	Disorders with prominent somatic symptoms associated with impairment and distress	somatic symptom disorder conversion disorder factitious disorder

Dissociative disorders	Disruption or discontinuity in the typical integration of consciousness, perception, memory, emotion, identity, or body representation	dissociative amnesia depersonalization/derealization disorder dissociative identity disorder
Feeding and eating disorders	Disturbance in eating or eating-related behaviour that impairs physical health and/or psychosocial functioning	avoidant/restrictive food intake disorder anorexia nervosa bulimia nervosa binge-eating disorder
Sexual dysfunctions	Disorders with great heterogeneity that usually involve a clinically significant disturbance in the ability to respond sexually or experience sexual pleasure	erectile disorder female sexual interest/arousal disorder male hypoactive sexual desire disorder
Gender dysphoria	Persistent distress due to the discrepancy between one's expressed or experienced gender versus the initially assigned gender	gender dysphoria
Paraphilic disorders	Disorders that reflect intense and persistent sexual interest other than the stimulation found in normal physically mature and consenting human partners	voyeuristic disorder frotteuristic disorder sexual sadism disorder
Sleep-wake disorders	Disorders involving dissatisfaction in the quality, timing, and/or amount of sleep	insomnia disorder hypersomnolence disorder narcolepsy central sleep apnea
Disruptive, impulse control, and conduct disorders	Under-controlled behaviours that violate the rights of others and/or bring the person into serious conflict with societal norms or	intermittent explosive disorder conduct disorder kleptomania

	authority figures	
Personality disorders	Pervasive and inflexible behavioural patterns that deviate markedly with societal expectations. These disorders often involve a lack of insight about how personal actions cause distress in others	borderline personality disorder narcissistic personality disorder paranoid personality disorder antisocial personality disorder

15.1 Psychology Around Us

Is a Diagnosis Always Helpful?

Although mental health terms such as anxiety, depression, and schizophrenia are commonly discussed in the media, public discourse, and even daily conversations, it turns out that accurate diagnoses of these and other psychological disorders are often elusive in the clinical field. It appears that even with effective assessment techniques and carefully researched classification categories, clinicians sometimes arrive at a wrong conclusion or diagnosis (Meder & Mayrhofer, 2017; Waldmann & Hagmayer, 2013).

Indeed, studies have sometimes revealed enormous errors in assessment and diagnosis, particularly in hospitals (Mitchell, 2010). In a well-known study assessing the possibility that schizophrenia was over-diagnosed and affective disorders under-diagnosed, the charts of 131 randomly selected patients from a mental hospital in New York were pulled from records and seven skilled clinicians were asked to reevaluate their diagnoses (Lipton & Simon, 1985). Whereas 89 of the patients had originally received a diagnosis of schizophrenia when they were hospitalized, only 16 received this same diagnosis on reevaluation. And while 16 patients initially had been given a diagnosis of mood disorder, 50 received that label on reevaluation, essentially reversing the ratio of schizophrenic to mood disorder.

Furthermore, our society attaches a stigma, or negative prejudice, to mental illness (Crowe, Averett, & Glass, 2016; Seeman, Tang, Brown, & Ing, 2016). Stereotypic beliefs about what it means to have or to have had a mental disorder can mark or stigmatize those currently or previously struggling with a mental disorder. This can make it less likely that they will seek treatment for fear of the stigmatizing consequences (Fox, Smith, & Vogt, 2018). People with such labels may find it hard to get a job, particularly one with a high level of responsibility, or to be accepted socially (Elraz, 2018). In short, such labels may stick for a long time.

Given these problems, some clinicians have argued for doing away with assessment and diagnosis. Others, however, believe that classification and diagnosis are essential to understanding and treating people with psychological difficulties. They suggest that we must simply work to increase what is known about psychological disorders and improve assessment and diagnostic techniques (Corrigan, 2007; Ben-Zeev, Young, &

Corrigan, 2010). On a positive note, a review of interventions aimed at reducing the stigma associated with mental illness in workplace settings suggests that such interventions can improve employee attitudes toward those with a history of mental illness (Hanisch et al., 2016).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

1. Define and explain the "four Ds" of abnormal behaviour.

2. What is the DSM-5?

What Do You Think? • In this section, we talked about the stigmatizing issues associated with being diagnosed with a mental disorder. Think about people you know or people you have heard about or read about who were described as "having a mental disorder." What sorts of things did you think or assume about them simply based on this knowledge? Any negative generalizations could become part of the stigma associated with mental disorders.

Models of Abnormality

LEARNING OBJECTIVE 2

Describe the major models used by psychologists to explain abnormal functioning.

The perspectives that scientists use to explain phenomena are known as *models*, or *paradigms* (Kuhn, 1962). You can think of a model or paradigm as a big idea about how things work. So, for example, a mechanistic paradigm builds on the idea that people are like complex machines and then when something goes wrong, it is probably because something in the mechanism is broken. To understand how a clinical theorist explains disorders, we must know which model shapes the theorist's view of abnormal functioning. Thus, in this section we will examine today's most influential clinical models—the neuroscience, psychodynamic, cognitive-behavioural, humanistic-existential, socio-cultural, and developmental psychopathology models (see Table 15.2). In the next chapter, we will see how these models inform treatment.

TABLE 15.2

Today's Leading Models of Abnormality

Approaches	Causes of Abnormal Functioning
Neuroscience	Structural or biochemical malfunctions in the brain

Approaches	
Psychodynamic Approaches	Unconscious conflicts often rooted in childhood
Cognitive-Behavioural Approaches	Abnormal behaviours acquired through a tightly interwoven mix of conditioning, modelling, and cognitive principles
Humanistic and Existential Approaches	Distorted views of self that prevent personal growth or decision making
Socio-cultural Approaches	Societal, cultural, social, and family pressures or conflicts
Developmental Psychopathology Approach	Early risk factors combined with poor resilience throughout life stages

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The Neuroscience Model

Neuroscientists view abnormal behaviour as an illness brought about by a malfunctioning brain (Pliszka, 2003). As we have seen throughout the textbook, researchers have discovered connections between certain psychological or neurological disorders and problems in specific structures of the brain. Neuroscientists have also linked some mental disorders to deficient or excessive activity of different neurotransmitters. Depression, for example, seems to be associated with insufficient activity of the neurotransmitters *norepinephrine* and *serotonin* (Beck & Alford, 2009; Blier, 2016). In addition to focusing on neurotransmitters, neuroscience researchers have learned that mental disorders are sometimes related to abnormal hormonal activity in the body's endocrine system. Abnormal secretions of the hormone *cortisol*, for example, also have been tied to depression (Qin et al., 2016; Vrshek-Schallhorn et al., 2013).

AP Photo/M. SPENCER GREEN

Extreme antisocial disorders and the brain **Forensic psychiatrist Helen Morrison displays slices of the brain of John Wayne Gacy, who murdered at least 33 boys and young men between 1972 and 1978. Post-mortem examinations have not revealed clear links between abnormal brain structure and the extreme antisocial patterns exhibited by Gacy and other serial killers.**

What causes these problems with brain anatomy and chemical functioning (see photo)? Two factors have received particular attention from clinical theorists in recent years: *genetics* and *viral infections*.

Studies suggest that genetic inheritance plays a key role in mood disorders, schizophrenia, intellectual disability, Alzheimer's disease, and other mental disorders. It appears that in most cases, no single gene is responsible for a particular disorder (Coleman et al., 2020; Uher & Zwicker, 2017). Instead, many genes combine to help produce our actions and reactions, both functional and dysfunctional. Moreover, as you have read throughout the textbook, the predispositions set up by such genes often will result in psychological disorders only when the individuals are also exposed to adverse environmental conditions.

Another possible source of abnormal brain structure or biochemical dysfunction appears to be viral infections. Some research suggests, for example, that schizophrenia, a disorder marked by hallucinations and other departures from reality, may be related to exposure to certain viruses before birth or during childhood (Torrey & Yolken, 2017). The studies suggest that a damaging virus may enter the brain of a fetus or young child and then remain quiet there until the individual reaches puberty or young adulthood. At that time, activated

by hormonal changes, by another infection, or by stressful life events, the virus may set in motion the symptoms of schizophrenia. In addition to schizophrenia, research has sometimes linked viruses to mood and anxiety disorders (Torrey & Yolken, 2017). Exposure to traumatic events early in childhood has also been linked to the later onset of symptoms of schizophrenia (Stilo & Murray, 2019).

Today, the neuroscience model for understanding mental dysfunction is highly regarded, and researchers are rapidly identifying valuable new information about various psychological and neurological disorders (Rodgers et al., 2017; Littrell, 2015). As you will see in Chapter 16, drug treatments and biological interventions such as psychotropic medications or electroconvulsive therapy (ECT) often bring great symptomatic relief where other approaches have failed.

At the same time, some proponents of the neuroscience model seem to expect that biological factors and brain interventions alone can explain and treat all abnormal behaviours. However, to better understand mental health and mental illness we need to avoid dependency on *reductionist perspectives* that attempt to reduce complex phenomenon to a single cause (Bulut, Gursoy, & Sayar, 2020). Reductionist views such as biomedical models neglect the complex interplay of biological and non-biological factors, including a person's environmental experiences. Indeed, as we have seen throughout this book, the connections in our brains unfold partly in response to the experiences that we keep having throughout our lives, beginning in the womb.

So, since we know that the mind affects the body and that the body also affects the mind, we must come to understand the complex interactions between the biological, social, psychological, and cultural variables present in the lives of all individuals. The *biopsychosocial perspective*, first identified by George Engel (1980, 1977), recognizes the links between each of these important areas of human development (Wade & Halligan, 2017). The biological component involves a focus on genetic and epigenetic factors as well as biochemical influences and differences in brain structure and function. The psychological component includes interpersonal interactions, personality variables, cognitive and learning histories and development, attitudes, and ability to cope. The social component considers socialization experiences, cultural and social interactions and variables, and life experiences. When studying mental illness, the focus is on how these variables interact to produce the behaviours being treated. However, this model can be employed for describing typical development as well.

The notion that disorders arise from an interaction of internal and external causes resulted in a model known as the *diathesis-stress model*. This model suggests that a person may inherit a genetic predisposition (a diathesis) for a disorder, but that it will remain undeveloped unless triggered by an external (stressful) life event. So, for example, you and your brother may have both inherited a predisposition for depression. However, he is in a serious car accident where two of his childhood friends are killed; he feels terrible guilt for surviving this accident, and his capacity to cope is exceeded. You experience nothing like this. Your brother develops depression and you do not. Of course, we have to also consider that individuals respond to stressful events with quite different trajectories. That is to say, you may have experienced the same adverse event as your brother, but might have responded quite differently and thereby would not have triggered a psychiatric disorder (Monroe & Cummins, 2014).

Neuroscience and the *Diagnostic and Statistical Manual* (DSM) and *International Classification of Diseases* (ICD)

The discoveries of drugs that affected the symptoms of mental disorders, as will be discussed in Chapter 16, gave a strong push to the idea that mental disorders are, at least in part, brain-based and reflect ways in which our neurochemistry relates to our adaptive, and sometimes to our maladaptive, behaviour. Despite this, the role that neuroscience research has played in the development of the criteria and manuals for diagnosing—the *Diagnostic and Statistical Manual* (DSM) and *International Classification of Diseases* (ICD)—and the plans for treating mental disorders has been limited (Cuthbert, 2014; Kozak & Cuthbert, 2016). The work on the new edition of the DSM (DSM-5), for example, was conducted by large committees of clinicians and clinical researchers working in each diagnostic area of the manual. While there has been acknowledgement that it would be of great benefit to have clearer neurological assessment tools and research mapping the brain-based links of symptom patterns associated with one or more diagnostic category, it is generally felt that neuroscience has not yet provided needed clarity for sharp diagnostic decisions. In other words: We just need more research. The problem, as stated by Thomas Insel, the former director of the American National Institute of Mental Health, is that research-granting criteria and reviewing standards are based on the existing diagnostic categories of the DSM and ICD. This means that funded neuroscience research was not providing the knowledge and diagnostic and treatment guidelines needed to develop a neuroscience foundation for understanding and treating mental disorders.

The proposed solution is called the Research Domain Criteria (RDoC) project, which is intended to "foster research to validate dimensions defined by neurobiology and behavioral measures that cut across current disorder categories, and that can inform future revisions of our diagnostic systems" (Cuthbert, 2014, p. 29). Essentially this means looking at what we know about how the brain is systemically organized and then looking to see how brain functioning at different levels in each of those systems can help us to better understand both "normal" and abnormal thoughts and behaviour. The Research Domain Criteria model is shown in **Table 15.3**. In it you can see the areas or systems of brain functioning down the left side and the types of desired research analysis aimed at better understanding each area laid out across the top.

TABLE 15.3

The Research Domain Criteria Matrix for Guiding Neuroscience Research into No Abnormal Functioning
Source: Cuthbert, 2014.

	Units of Analysis							
Domains/Constructs	**Genes**	**Molecules**	**Cells**	**Circuits**	**Physiology**	**Behavior**	**Self-Reports**	**F**
Negative Valence Systems								
Acute threat ("fear")								
Potential threat ("anxiety")								

Sustained threat
Loss
Frustrated non-reward
Positive Valence Systems
Approach motivation
Initial responsiveness to reward
Sustained response to reward
Reward learning
Cognitive Systems
Attention
Perception
Working memory
Declarative memory
Language behavior
Cognitive (effortful) control
Systems for Social Processes
Affiliation/attachment
Social communication
Perception/understanding of self
Perception/understanding of others
Arousal/Modulatory Systems
Arousal
Biological rhythms
Sleep-wake

By beginning with a neuroscience perspective on the various brain systems and working toward an understanding of adaptive and abnormal behaviour, the RDoC is not limited by being applied only within already agreed upon diagnostic categories, though it could be of use in sorting out subtypes or variations of symptom patterns in disorder categories. For example, PTSD is regarded as very clearly a “fear circuit” disorder. Despite this, some patients have “blunted” emotional responses and do not show the expected fear reactions. Different therapy approaches work for fear-reactive as opposed to emotionally blunted individuals. The RDoC model would suggest the development of an assessment tool for emotional responsiveness in order to test therapy responsiveness and eventually, perhaps,

to ensure that diverse PTSD patients quickly get the appropriate therapy for their version of the disorder (Grant et al., 2020).

The potential impact of the RDoC on neuroscience research related to abnormal behaviour and the identification, diagnosis, and treatment of mental disorders is huge, especially given the millions of dollars in research funding given out each year by the U.S. National Institute of Mental Health. If you are interested in where some possible big changes in abnormal and clinical psychology are going to come from in the next few years, this is a good area to watch (Sanislow et al., 2019).

The Cognitive-Behavioural Model

Cognitive-behavioural theorists propose that psychological disorders result largely from a combination of problematic learned behaviours and dysfunctional cognitive processes. According to this model, such behaviours and thinking processes interact with and mutually influence each other: people use their particular ways of thinking to explain their behaviours and the events in their lives, behaviours may lead to particular thoughts, various cognitions may trigger certain behaviours, and so on. Cognitive-behavioural theorists also view emotions and biological events as key variables. And, indeed, they seek to understand how these variables influence and interact with behaviours and cognitions to help bring about abnormal functioning. Both behavioural and cognitive principles lie at the centre of the model (Friedman, Koenig, & Thase, 2016; Butler et al., 2006). Correspondingly, as you will see in Chapter 16, cognitive-behavioural therapists focus largely on behaviours and cognitions in their efforts to help people with psychological disorders by helping them to change their thoughts and behaviours.

To more fully understand the cognitive-behavioural model, it is useful to first examine the behavioural and cognitive components separately. In fact, at one time, the behavioural model stood alone, and behaviourists used only principles of conditioning and modelling to explain abnormal functioning. In the 1960s, however, a number of theorists began calling for a more cognitive-behavioural perspective (Beck, 1975). They argued that human beings engage in unseen *cognitive behaviours*, such as private thoughts and beliefs, and that people's cognitions greatly influence and are influenced by their behaviours.

The Behavioural Perspective

As we observed in Chapter 7, behavioural theorists use learning principles to explain human functioning. These principles focus on how the environment changes a person's behaviours. Many learned behaviours are constructive and help people to cope with daily challenges and lead satisfying lives. However, abnormal and undesirable behaviours also can be learned.

According to the behavioural perspective, abnormal behaviours are acquired by the same principles of learning as adaptive behaviours. As you saw in Chapter 7, for example, phobias may occur as a result of *classical conditioning* when a previously neutral object becomes paired with an unconditioned stimulus that creates fear (see photo).

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"Virtual" desensitization Virtual reality software enables phobic clients to more vividly experience their feared objects and situations, such as flying in an airplane, during desensitization.

Behavioural theorists also suggest that some of the many behaviours we learn through *operant conditioning* processes of reward and punishment are abnormal ones. For example, some people may learn to abuse alcohol and drugs because initially such behaviours brought feelings of calm, comfort, or pleasure. Others may develop or continue to display disordered eating patterns partly because of praise they receive for a thinner appearance or because of the comfort eating certain foods provides them (Gibson, 2012; Wilson, 2011).

Modelling, in which we learn by observing others, can also lead to abnormality. Recall from Chapter 7 the famous study in which children learned from a model to behave aggressively toward a Bobo doll, an inflatable clown (Bandura, Ross, & Ross, 1963). Similarly, children of psychologically dysfunctional people may develop maladaptive reactions because of their exposure to the models presented by their parents (O'Neal et al., 2016; Rossman, Hughes, & Rosenberg, 2013; Luyckx et al., 2011).

One of the appeals of behavioural principles is that, in contrast to psychodynamic concepts, they can be tested in the laboratory. Experimenters have used the principles of conditioning to produce clinical symptoms in research participants, suggesting that psychological disorders may in fact develop through learning (Morris, Rumsey, & Cuthbert, 2014). Moreover, as you will see in Chapter 16, research has indicated that behavioural interventions can be helpful to people with specific fears, compulsive behaviours, social deficits, intellectual disabilities, and a wide range of other problems (Wilson, 2011).

The Cognitive Perspective

According to the cognitive perspective, when people display abnormal patterns of functioning, cognitive problems are to blame. Abnormal functioning can result from several such problems, including *maladaptive beliefs* and *illogical thinking processes* (see photo).

Colin Hawkins/Cultura/Getty Images

Cognition and psychological disorders **Social isolation and difficulties in problem solving can make it harder for people to get help with depression.**

The pioneering clinical theorists Albert Ellis (1913–2007) and Aaron Beck proposed that each of us holds broad beliefs about ourselves and our world that help to guide us through life and determine our reactions to the situations we encounter. However, some people's beliefs are unjustified and unhelpful, leading them to act and react in ways that are inappropriate and that reduce their chances of happiness (Barth, 2014; Beck & Haigh, 2014).

Such people may, for example, assume that they are failures if they are not loved or approved of by every person they know. An otherwise successful presentation in the classroom can, for example, make them sad or anxious because one listener seemed bored. Their problematic belief helps set the stage for a life hampered by tension and disappointment.

Think back to Diane Markos, whose case opened this chapter. She held some unjustified beliefs that may have left her particularly vulnerable to depression. Her case study further stated:

> *Many of her [problems] seemed to stem from underlying attitudes . . . such as: "If I care for others, they should/must care for me," or "If something good happens to me, I'll have to pay for it later with pain," or "People either love me or hate me"* (Spitzer et al., 1983, p. 129).

As is discussed in Chapter 16, Beck also found that some people continuously think in illogical ways and keep drawing self-defeating and even pathological conclusions (Beck & Weishaar, 2011). He identified several illogical thinking processes—processes that turn out

to be very common in depression and anxiety disorders. These include:

Selective perception—seeing only the negative features of an event.

Magnification—exaggerating the importance of undesirable events.

Overgeneralization—drawing broad negative conclusions on the basis of a single insignificant event.

Diane Markos's therapist noted repeated examples of illogical thinking that helped predispose Diane to depressive reactions:

> *When she finally did get a B from her professor, she concluded that she had failed miserably. There was no recognition of any middle ground between total academic success and total academic failure. Moreover, she tended to magnify the importance of events like this as if they were an indictment of her as a total human being* (Spitzer et al., 1983, p. 129).

The cognitive perspective has appealed to a wide range of theorists. They embrace a viewpoint that sees *thought* as a key factor in both normal and abnormal behaviour. Research supports this appeal. Investigators have found that people with psychological disorders do, indeed, often display the kinds of beliefs and errors in thinking described in the cognitive theories (Gellatly & Beck, 2016; Sharf, 2012; Buschmann et al., 2018). The cognitive perspective provides ways to challenge such negative beliefs and cognitive errors and thus to reduce stress and increase happiness. Parts of this have contributed to the development of Positive Psychology, though recently there have been some suggestions and some research into the need for a New Positive Psychology (PP 2.0) which moves beyond the simpler "happiness is good" approach to a more nuanced "embrace the challenges" approach. Find out about this be reading Positive Psychology 15.1.

The Psychodynamic Model

The psychodynamic model has its roots in Sigmund Freud's theories. As we observed in Chapter 12, psychodynamic theorists believe that a person's behaviour is determined largely by underlying psychological forces of which the person is not consciously aware. Abnormal behaviours or symptoms are viewed as the consequences of conflicts between these forces or as unconscious attempts to resolve conflicts and lessen painful inner turmoil.

Fancy/Veer/Corbis/Getty Images

Anal personality? According to Freud, when an individual's neat and orderly personality is as extreme as this woman's (prior to storing her knickknacks, she organizes them carefully before her and enters each item on a computer file), fixation at the anal stage of development may be operating.

As we pointed out in Chapter 12, Freud proposed that a child's environment may prevent his id, ego, and superego from maturing properly or interacting effectively. When that happens, the child can become *fixated*, or entrapped, at an early stage of development. Such fixations affect all subsequent development and may set in motion abnormal functioning (see photo).

Freud would have suggested that the family pressures Diane Markos experienced during her early years caused an imbalance of power among her id, ego, and superego. The demands she experienced forced her to put aside many of her own id needs and to act in a mature, ego-dominated manner beyond her years. Freud would certainly have looked upon such childhood pressures and deprivations as possible roots for her adult depression.

15.1 Psychology Around Us | Positive Psychology

The Second Wave of Positive Psychology

Throughout this book you have read about a relatively new field of psychology: positive psychology. However, it has not been without controversy. Over the last several decades, critics of this field have highlighted the need for a more balanced, or nuanced, approach to how we perceive positive and negative qualities, especially regarding how our perception of these qualities affects our understanding of mental health—especially mental illness. For example, optimism can be seen as a positive trait that all of us may want. However, in certain cases of attention deficit/hyperactivity disorder, the verbalizing and setting of overly optimistic goals may actually be a negative, not positive, aspect of optimism (Knouse & Mitchell, 2015). Optimism in bipolar disorder, specifically the mania phase, may also be biased toward an overly optimistic belief of future events that is not realistic, and may actually be harmful

(Schönfelder, Langer, Schneider, & Wessa, 2017). Perhaps the idea that all positive traits are good and improve life all of the time needs to be re-thought.

Recently, a second wave of positive psychology, known as PP 2.0, has emerged from this sort of re-thinking; perhaps acknowledging that life is sometimes not so positive is not a bad thing. PP 2.0 has implications for both how we view mental illness and how we view the contributions of positive psychology to counselling psychology. It has been argued that there is courage in accepting that life is made up of both good and bad elements and also that we can learn from Indigenous psychology, which tries to find deep joy in bad situations (Wong, 2019). Some examples of PP2.0 research include; the finding that people who hotly pursue happiness are more likely to be more depressed, miserable, and unhappy (Gruber, Mauss, and Tamir, 2011) and suffering and psychological pain are most effectively addressed not by ignoring it but, rather, by accepting it and transforming its meaning (López-Solà, Koban, & Wager, 2018). PP 2.0 is looking at the long term value in embracing the darker sides of human existence and wrestling with our ultimate concerns (Wong, 2019). Margaret Trudeau's book *Changing My Mind* addresses in part this dialectic between the good and bad aspects of traits such as optimism that all individuals, those with and those without a mental illness, must face (Lomas & Ivtzan, 2016).

Zyn Chakrapong/Shutterstock

Positive and negative qualities **Accepting that life is made up of both negative and positive elements that affect our mental health may have long-term value when it comes to facing a mental illness and the challenges it can bring to a person's life.**

As we also saw in Chapter 12, several of Freud's colleagues disagreed with key aspects of his theories. As a result, there are now a number of different psychodynamic explanations for abnormal functioning (Sharf, 2012). For example, one group of psychodynamic theorists, called *object relations* theorists, believes people are motivated primarily by a need to establish relationships with others, known as *objects* (see photo). They propose that severe problems in early relationships may result in abnormal development and psychological problems (Phares, 2020; Guntrip, 2018; Huprich et al., 2017).

Pepsco Studio/Shutterstock

Setting the stage **Object relations theorists believe that early relationships in life, particularly with parents, are key to adult functioning.**

Freud and his followers helped change the way abnormal functioning is viewed (Wolitzky, 2011). Primarily because of their work, many different kinds of theorists today look for explanations outside biological processes. In addition, Freud and his followers were the first practitioners to demonstrate the value of systematically applying theory and techniques to treatment. However, as you will see in Chapter 16, research has often failed to support the effectiveness of psychodynamic therapies (Prochaska & Norcross, 2010).

The Socio-Cultural Model

According to many theorists, abnormal behaviour is best understood in light of the social, cultural, and family forces brought to bear on an individual. The unique characteristics of a given society may create special stresses that heighten the likelihood of abnormal functioning in its members. Researchers have, for example, found relationships between abnormal functioning and factors such as widespread social change, socio-economic class membership, cultural background, social networks, and family systems (Kirmayer, Gomez-Carrillo, & Veissière, 2017; Ventriglio, Gupta, & Bhugra, 2016).

Social Change

When a society undergoes major change, the mental health of its members can be greatly affected. Societies undergoing rapid urbanization, for example, usually show a rise in mental disorders (Anakwenze & Zuberi, 2013). It is not yet known which features of urbanization—overcrowding, technological change, social isolation, migration, and so forth

—are most to blame. Similarly, societies in the throes of economic depression often display rises in rates of clinical depression and suicide (Miret et al., 2013).

Socio-economic Class

Studies by Jitender Sareen, Brian Cox, and Murray Stein at the University of Manitoba have found that rates of psychological abnormality, especially severe abnormality, are much higher among members of the lower socio-economic classes than among members of the higher ones (Keyes et al., 2014; Sareen et al., 2011). Perhaps the special pressures of lower-class life help explain this relationship. Poverty is linked to many stressors, including high rates of crime, unemployment, overcrowding, and even homelessness, as well as inferior medical care and limited educational opportunities (see photo). Of course, other factors may account for this relationship. People who suffer from significant mental disorders may be less effective at work, earn less money, and, as a result, drift downward to settle in a lower socio-economic class (Tiikkaja et al., 2016; Sayeed & Fernando, 2018; Lee et al., 2020).

ROMEO RANOCO / REUTERS/ADOBE STOCK

The economy and mental health **Thousands of Filipino job seekers line up at a 2009 job fair in Manila. Unemployment and poverty are strongly linked to psychological dysfunction.**

Cultural Factors

Many theorists believe that human behaviour, including abnormal behaviour, is understood best by examining an individual's unique cultural context, including the values of that culture and the external pressures faced by members of the culture (Matsumoto & Juang, 2016; Duarte et al., 2020a; 2020b; Alegría et al., 2018). As we have seen throughout this book, the cultural groups that have been studied most often are ethnic and racial minority groups, along with economically disadvantaged persons, women, and LGBTQ+ individuals

(see photo). Each of these groups faces special pressures in society that may help produce feelings of stress and, in some cases, abnormal functioning. Moreover, of course, membership in these groups often overlaps.

Kevin Mazur/One Love Manchester/Getty Images

Pressures of discrimination **In June 2017, Ariana Grande performed a benefit concert for victims of the suicide terrorist bombing of her concert in Manchester, England. Multicultural research suggests that prejudice and discrimination can contribute to abnormal functioning.**

Researchers have learned that women are at least twice as likely as men to be diagnosed with depressive and anxiety disorders, although this may be due partially to women being more likely than men to seek treatment (Brown, Sagar-Ouriaghli, & Sullivan, 2019; Seidler et al., 2016; Yousaf, Grunfeld, & Hunter, 2015). Suicide rates in the Canadian Indigenous population are more than twice the overall rate and three times the age-specific rates of non-Indigenous Canadians (24.3 deaths per 100,00 among First Nations people, which is three times the general population rate of 8.1 deaths per 100,000; 14.7 deaths per 100,000 among Metis people; and 72.3 deaths per 100,000 among Inuit people) (Kumar & Tjepkema, 2019). Indigenous Canadians also display extremely high alcoholism rates (Lemstra et al., 2013). In Canada, cultural origins, immigrant status, and Indigenous status have been linked to varying rates of mental illness and adjustment issues (Boksa, Joober, & Kirmayer, 2015; Kirmayer & Valaskakis, 2009). Racial and sexual prejudice and related problems certainly may help explain these differences (Reading & de Leeuw, 2014; Goodman et al., 2017).

A good example of the role of culture in mental health comes from the work of Michael Chandler (University of British Columbia) and Chris Lalonde (University of Victoria). They examined the youth suicide rates among a large number of First Nations band communities in British Columbia. In addition to suicide rates, Chandler and Lalonde gathered data regarding whether each band was or had been engaged in land claim negotiations with the

provincial government; whether the band had taken control of education, fire, police, and child welfare services in their community; and whether there was a physical structure in the community dedicated to their cultural heritage. Their results indicate that if all of these factors were in place, the youth suicide rate was among the lowest in Canada; if none of them were in place, the rates were among the highest in Canada (Chandler & Lalonde, 2019; Chandler et al., 2003; Chandler & Proulx, 2008). These results suggest that having a strong, culturally rich context in which to develop has a significant positive effect on individual mental health and identity development.

Another cultural factor that has received much attention from clinical researchers and therapists in recent years is religion. Researchers have studied possible links between religious faith and mental health, and have learned that the two are often correlated. Studies have found, for example, that genuinely spiritual people tend, on average, to be less lonely, pessimistic, depressed, or anxious than other people (Underwood, 2011). Moreover, as we observed in Chapter 14, such individuals often seem to cope better with major life stressors and appear less likely to abuse drugs or to attempt suicide. Spirituality can be a source of comfort, hope, and meaning, which may at least partially account for this spirituality effect (McClintock, Lau, & Miller, 2016; Koenig, 2012).

Social Networks and Supports

Many theorists focus on the social networks in which people operate, including their social and professional relationships. How well do they communicate with others? What kind of signals do they send to or receive from others? Researchers have often found ties between deficiencies in a person's social networks and that person's functioning (Liu, Gou, & Zuo, 2016; Lee, Chung, & Park, 2016; Santini et al., 2016; Bryant et al., 2016). They have observed, for example, that people who are isolated and lack social support or intimacy in their lives are more likely to become depressed when under stress and to remain depressed longer than are people with supportive spouses or warm friendships. Some recent research indicates that for adolescents and young adults, social media may provide a conduit for social connections that helps them deal with mental health issues (Singleton, Abeles, & Smith, 2016; Best, Manktelow, & Taylor, 2016).

Family Systems

According to **family systems theory**, the family is a system of interacting parts—the family members—who interact with one another in consistent ways and follow rules unique to each family (Keller & Noone, 2019; Goldenberg & Goldenberg, 2011). Family systems theorists believe that the *structure* and *communication* patterns of certain families actually force individual members to react in ways that otherwise seem abnormal. If the members were to behave normally, they would severely strain the family's usual manner of operation and would actually increase their own and their family's turmoil.

> **family systems theory** a theory holding that each family has its own implicit rules, relationship structure, and communication patterns that shape the behaviour of the individual members.

Recall, for example, how Diane Markos's family was structured. She was required to be a

third parent in the family, which in many ways deprived her of normal childhood experiences and emotions. In turn, she came to view her life as one of "servitude, rejection, and failure," and she experienced ongoing depression.

The Developmental Psychopathology Model

Developmental psychopathology is an area that is interested in how psychological disorders evolve, based on both genetics and early childhood experiences. Researchers interested in this area try to understand how early problematic patterns affect functioning as individuals move through later life stages (Cicchetti & Toth, 2016; Leventhal et al., 2016; Cicchetti, 2016; Hinshaw & Beauchaine, 2017). Developmental psychopathologists compare and contrast abnormal behaviour patterns with more typical ones, attempting to identify **risk factors**—biological and environmental factors that contribute to negative outcomes. In addition, they seek to identify other factors that can help children avoid or recover from such outcomes.

> **developmental psychopathology** the study of how problem behaviours evolve as a function of a person's genes and early experiences, and how these early issues affect the person at later life stages.
>
> **risk factors** biological and environmental factors that contribute to problem outcomes.

Like other developmental psychologists, developmental psychopathologists hold that behaviour can be analyzed in a variety of ways. A full accounting of how individuals get off-track (or stay on-track) requires looking at how genetics, early environmental influences, and their own psychological processes all collaborate to form their current pattern and functioning.

Developmental psychologists have contributed two concepts to the field of psychology: *equifinality* and *multifinality* (Oshri et al., 2017; Barrett, 2019). The concept of **equifinality** holds that individuals can start out from a variety of different places and yet, through their life experiences, wind up functioning (or dysfunctioning) in similar ways. **Multifinality** follows the opposite principle. It suggests that children can start from the same point and wind up in any number of different psychological places.

> **equifinality** the idea that different children can start from different points and wind up at the same outcome.
>
> **multifinality** the idea that children can start from the same point and wind up at any number of different outcomes.

Let's apply these two concepts to *conduct disorder*, a disorder of childhood and adolescence characterized by repeated violations of others' rights, displays of aggression, and destructive behaviour. A child with this disorder may have been born with a difficult temperament, experienced poor parenting, or developed poor social skills (Vaughn, Salas-Wright, DeLisi, & Maynard, 2014; Ronan et al., 2016). As suggested by the notion of *equifinality*, regardless of which set of those risk factors is at play, in the beginning the

outcome is the same, in this case, conduct disorder. At the same time, *multifinality* would predict that not every difficult child and not every child with ineffective parents will wind up with a conduct disorder. The vast majority will wind up with no pathology at all. So children with similar beginnings can end up in very different places.

Developmental psychopathologists are very interested in the biological, psychological, or environmental events that help buffer against or negate the impact of risk factors—events that help produce **resilience**, an ability to recover from or avoid the serious effects of negative circumstances (Cicchetti, 2016; Dudley et al., 2011; Flouri et al., 2011). In short, according to this viewpoint, it is more important to understand what goes right than it is to understand what goes wrong.

resilience the ability to recover from or avoid the serious effects of negative circumstances.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

3. What are the major models used by psychologists to explain abnormal functioning?

4. What major types of brain problems are linked to abnormal functioning?

5. In the view of cognitive-behavioural theorists, what kinds of problems can lead to abnormal functioning?

6. How are the humanistic and existential models similar, and how do they differ?

7. What social and cultural factors have been found to be related to abnormal functioning?

What Do You Think? • How would you describe your personal model for explaining why people behave as they do?

Mood Disorders

LEARNING OBJECTIVE 3

Describe and differentiate major depressive disorder and bipolar disorder.

As you saw earlier, there are more than 200 different disorders listed in DSM-5. In the rest of this chapter, we will look at some of the disorders that are particularly common and that have received considerable study. We begin with mood disorders. Moods are temporary, non-specific emotional states. Mood disorders are mental disorders characterized by pervasive disturbed mood as the dominant feature. There are two primary types of mood disorder: unipolar mood disorder, also called depression, and bipolar disorder, where

people move between one extreme mood state to another (see photo).

PeopleImages/Getty Images

Mood disorders In mood disorders, individuals experience either unipolar mood disorder (where they experience depression) or bipolar disorder (where they move from one extreme mood state to another).

Depression and mania are the key features in mood disorders. **Depression** is a low, sad state in which life seems dark and hopeless and its challenges seem overwhelming. **Mania**, the opposite of depression, is a state of breathless euphoria, or frenzied energy, in which people may have an exaggerated belief that the world is theirs for the taking. Most people with a mood disorder suffer only from depression, a pattern found in **major depressive disorder** or in a less disabling but chronic form of depression called Persistent Depressive Disorder (dysthymia). Others experience periods of mania that alternate or intermix with periods of depression, a pattern called **bipolar disorder** in its severe form and *cyclothymic disorder* in a less severe but chronic form (Frank & Michael, 2013; Beck & Bredemeier, 2016).

depression a persistent sad state in which life seems dark and its challenges overwhelming.

mania a persistent state of euphoria or frenzied energy.

major depressive disorder a disorder characterized by a depressed mood that is significantly disabling and is not caused by such factors as drugs or a general medical condition.

bipolar disorder a mood disorder in which periods of mania alternate with periods of depression.

Major Depressive Disorder

People more unhappy than usual often say they are “depressed.” Typically, they are

responding to sad events, fatigue, or unhappy thoughts. This use of the term confuses a perfectly normal mood swing with a clinical syndrome. All of us experience dejection from time to time; few of us experience major depressive disorder. This disorder brings severe and long-lasting psychological pain that may intensify as time goes by. Those who suffer from it may become unable to carry out the simplest of life's activities. Some even try to end their lives.

It is estimated that nearly 8 percent of adults in Canada are diagnosed with major depressive disorder in any given year. Another 3 percent of adults are diagnosed with mild forms of the disorder (Canadian Mental Health Association, 2014b; Mental Health Commission of Canada, 2013). Women are at least twice as likely as men to be diagnosed with depression. It is important to note that this difference between men's and women's rates of depression could reflect a number of factors, such as women's greater tendency to seek assistance; men's tendency to deny or pay less attention to their feelings; and women's greater likelihood of carrying the stress of multiple roles as parent, spouse, and employee. These factors can lead to differential diagnosis rates, without telling us about the actual underlying rates of disorders like depression among men and women (Salk, Hyde, & Abramson, 2017; Yoon & Kim, 2018). Approximately half of people with this disorder recover within six weeks, and 90 percent recover within a year, some without treatment (Klein & Allmann, 2015). However, most of them have at least one other episode of depression later in their lives (Bukh, Andersen, & Kessing, 2016; Fuller-Thomson, Agbeyaka, LaFond, & Bern-Klug, 2016).

TABLE 15.4

The Diagnostic Criteria for a Major Depressive Episode from the DSM-5
Source: Reprinted with permission from the *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition. Copyright ©2013 American Psychiatric Association.

Major Depressive Episode
A. Five (or more) of the following 9 symptoms have been present during the same two-week period and represent a change from previous functioning; at least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure.
B. The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.
C. The episode is not attributable to the physiological effects of a substance or to another medical condition.
(1) Depressed mood most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad or empty) or observation made by others (e.g., appears tearful) *Note:* In children and adolescents, can be irritable mood.
(2) Markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day (as indicated by either subjective account or observation made by others)
(3) Significant weight loss when not dieting or weight gain (e.g., a change of more than 5%

of body weight in a month), or decrease or increase in appetite nearly every day *Note:* In children this may be a failure to make expected weight gains.
(4) Insomnia or hypersomnia nearly every day
(5) Psychomotor agitation or retardation nearly every day (observable by others)
(6) Fatigue or loss of energy nearly every day
(7) Feelings of worthlessness or excessive or inappropriate guilt nearly every day
(8) Diminished ability to think or concentrate, or indecisiveness, nearly every day
(9) Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide

The DSM-5 diagnostic criteria for a major depressive episode are listed in **Table 15.4**. Due to space limitations, we have not included the DSM diagnostic criteria for the other disorders we discuss in this chapter. If you are interested in reviewing the diagnostic criteria for other disorders, search online using the following terms: DSM-5 criteria for "name of disorder." This search will return many websites showing the DSM diagnostic criteria for the disorder in question. Make sure that the site you choose to view clearly states that the criteria it displays are from the DSM (the most recent version is the DSM-5) and that the site references the DSM as the source of the material. That way you can be reasonably confident that the criteria being shown are accurate.

Hans Neleman/Getty Images

Feeling blue **Feeling sad is not necessarily depression. Major depressive disorder brings severe and long-lasting psychological pain that may intensify as time goes by.**

As we saw in the case of Diane Markos, severe depression has many symptoms other than sadness, and the symptoms often feed into one another. The symptoms span five areas of functioning: emotional, motivational, behavioural, cognitive, and physical.

Characteristics of Depression

Most people who are depressed feel sad and dejected (see photo). They describe themselves as "miserable" and "empty." They often lose the desire to participate in their usual activities. Almost all report a lack of drive, initiative, and spontaneity. Many depressed people become uninterested in life or wish to die; others wish that they could kill themselves, and some actually try. Suicide represents the ultimate escape from life's activities and pressures. It has been estimated that between 6 and 16 percent of people who suffer from severe depression commit suicide (De Leo & San Too, 2014; Laursen et al., 2016).

Depressed people are usually less active and less productive than other people. They spend more time alone and may stay in bed for long periods. They may also move and even speak more slowly than others. Most hold extremely negative views of themselves. They consider themselves inadequate, undesirable, inferior, and perhaps evil. They also blame themselves for nearly every unfortunate event (Lakey et al., 2014). Another cognitive symptom of depression is pessimism. Sufferers are usually convinced that nothing will ever improve, and they feel helpless to change any aspect of their lives (Pu, Hou, & Ma, 2016; Tuckwiller & Dardick, 2018). Finally, people who are depressed often have physical ailments such as headaches, indigestion, constipation, dizzy spells, and general pain. They may also have disturbances in appetite and sleep (Bekhuis et al., 2016; Schaakxs et al., 2017).

Major depressive disorders often seem to be triggered by stressful events (Park et al., 2019; Kendler & Gardner, 2016). (See Psychology Around Us 15.2.) In fact, researchers have found that depressed people experience a greater number of stressful life events during the month just before the onset of a depressive episode than do other people during the same period of time (Kendler & Gardner, 2016; Monroe, Anderson, & Harkness, 2019). However, it is important to remember that stress is not just something that happens *to* us. For instance, Kate Harkness and her associates at Queen's University found evidence that higher rates of interpersonal stress generation (in a sample of adolescent girls with a history of childhood maltreatment) predicted depression (Holshausen, Bowie, & Harkness, 2016; Harkness, Lumley, & Truss, 2008). Research done at the University of Toronto addressed whether people act in ways that keep existing stress going (i.e., stress continuation) or generate new stress. The data suggested that not only was new stress created, but stress generation was implicated in both depression and anxiety (Uliaszek et al., 2012).

Today's leading explanations for major depressive disorder point to neuroscience, psychological, or socio-cultural factors. Many theorists believe that the various explanations should be combined to more fully understand people with this disorder (Beck & Bredemeier, 2016). We will examine them separately here so that each perspective is clear.

15.2 Psychology Around Us

The Case of Andrea Yates

On the morning of June 20, 2001, 36-year-old Andrea Yates called police and explained that she had drowned her five children in the bathtub because "they weren't

developing correctly." She recounted the order in which the children had died: first 3-year-old Paul, then 2-year-old Luke, followed by 5-year-old John, 6-month-old Mary, and 7-year-old Noah.

As many as 80 percent of mothers experience "baby blues" soon after giving birth, and around 17 percent display the clinical syndrome of *postpartum depression* (Shorey et al., 2018). Postpartum psychosis, by contrast, is an entirely different disorder (VanderKruik et al., 2017; Bergink, Rasgon, & Wisner, 2016).

Postpartum psychosis affects about 1 to 2 of every 1,000 mothers who have recently given birth (VanderKruik et al., 2017). The symptoms apparently are triggered by the enormous shift in hormone levels that occur after delivery (Bergink et al., 2016). Within days or at most a few months of childbirth, the woman develops signs of losing touch with reality, such as delusions (for example, she may become convinced that her baby is the devil); hallucinations (perhaps hearing voices); extreme anxiety, confusion, and disorientation; disturbed sleep; and illogical or chaotic thoughts (for example, thoughts about killing herself or her child).

Women with a history of bipolar disorder, schizophrenia, or major depressive disorder are particularly vulnerable to the disorder (Raza & Raza, 2019). In addition, women who have previously experienced postpartum depression or postpartum psychosis have an increased likelihood of developing this disorder after subsequent births (Raza & Raza, 2019; Nonacs, 2007). Andrea Yates, for example, had developed signs of postpartum depression (and perhaps postpartum psychosis) and attempted suicide after the birth of her fourth child. At that time, however, she appeared to respond well to a combination of medications, and so she and her husband later decided to conceive a fifth child (King, 2002).

After the birth of her fifth child, the symptoms did in fact recur, along with features of psychosis. Yates again attempted suicide. Although she was hospitalized twice and treated with various medications, her condition failed to improve. Six months after giving birth to Mary, her fifth child, she drowned all five of her children.

Most clinicians who are knowledgeable about this rare disorder agree that Yates was indeed a victim of postpartum psychosis. Although only a fraction of women with the disorder actually harm their children (estimates run as high as 4 percent), the Yates case reminds us that such an outcome is indeed possible (VanderKruik et al., 2017; Raza & Raza, 2019). The case also reminds us that early detection and treatment are critical (Bergink et al., 2016).

After a second trial for murder in 2007, Yates was found *not guilty by reason of insanity* and sent to a high-security mental health facility for treatment. Some months later, she was transferred to a low-security state mental hospital where she continues to receive treatment.

How Do Neuroscientists Explain Depression?

If people inherit a predisposition to major depressive disorder, we would expect a particularly large number of cases among the close relatives of depressed persons (Neale,

2013). Twin studies support this expectation (Wang et al., 2020; Waszczuk et al., 2016). One investigation, for example, looked at nearly 200 pairs of twins. When a *monozygotic* (*identical*) twin had depression, there was a 46 percent chance that the other twin would have the same disorder. In contrast, when a *dizygotic* (*fraternal*) twin had depression, the other twin had only a 20 percent chance of developing the disorder (McGuffin et al., 1996).

If genetic influences are indeed at work in unipolar depression, what biological factors might ultimately produce the disorder? Researchers have focused most often on abnormal neurotransmitter activity—namely, low activity of norepinephrine and serotonin (Ferrari & Villa, 2017).

In the 1950s, several pieces of evidence began to point to these neurotransmitters. First, medical researchers discovered that several medications for high blood pressure often caused depression (Ayd, 1956). As it turned out, some of these medications lowered norepinephrine activity and others lowered serotonin. A second piece of evidence was the discovery of the first truly effective antidepressant drugs. These drugs were discovered almost by accident. In 1956, Roland Kuhn, a psychiatrist working in Switzerland, was administering a new trial drug to patients with schizophrenia. The drug did not seem to work, and in fact made symptoms worse in some patients. Kuhn noticed, however, that those patients with comorbid symptoms of depression showed improvement in their depressive symptoms while on the drug. Kuhn tried the drug with patients who were only showing depressive symptoms, and many of them improved dramatically (Cahn, 2006). With these initial observations in hand, researchers soon learned that they could relieve the symptoms of depression for some people by increasing either norepinephrine or serotonin activity (Bunney & Davis, 1965; Schildkraut, 1965).

An enormous number of studies over the past half-century have further supported the notion that major depressive disorder is related to low activity of norepinephrine and/or serotonin. Neuroscience research has also indicated that the body's endocrine system may play a role in depression. People with depression have been found to have high levels of cortisol, the hormone released by the adrenal glands during times of stress (Keller et al., 2017; Palazidou, 2012). This relationship is not all that surprising, given that stressful events often seem to trigger depression. Recent research suggests that cortisol levels may, in fact, predict responsiveness to therapy for depressive symptoms (Fischer et al., 2016).

How Do Cognitive-Behavioural Theorists Explain Depression?

Cognitive-behavioural theorists believe that people with severe depression acquire distinctly negative behaviours and think in dysfunctional ways that help cause and sustain their disordered symptoms (Kazantzis et al., 2018; Cristea et al., 2015). The two most influential cognitive-behavioural explanations centre on the phenomenon of learned helplessness and on the power of negative thinking.

Learned Helplessness

Since the mid-1960s, psychologist Martin Seligman has been developing the *learned helplessness* theory of depression (Maier & Seligman, 2016; Forgeard et al., 2011; Gillham et al., 2011; Seligman 1992, 1975). This theory holds that people become depressed when they think: (1) that they no longer have control over the rewards and punishments in their

lives, and (2) that they themselves are responsible for this helpless state.

Seligman's theory first began to take shape when he was working with laboratory dogs. He found that when dogs were given inescapable shocks, they came to learn that they have no control over the unpleasant punishments (shocks) in their lives. That is, they learned that they were helpless to do anything to change negative situations. You may recall from Chapter 7 that this phenomenon is called *learned helplessness*. Moreover, when later placed in a new situation where they could in fact escape shocks and control their fate, the dogs continued to act as if they were generally helpless. They would just lie in their experimental boxes and accept the shocks. Seligman noted that the effects of learned helplessness greatly resemble the symptoms of human depression, and he proposed that people become depressed after developing a general belief that they have no control over the rewards and punishments in their lives (Maier & Seligman, 2016; Seligman, 1975).

The learned helplessness explanation of depression has been revised somewhat over the past two decades. According to another version of the theory, the *attribution-helplessness theory*, when people view events to be beyond their control, they ask themselves why this is so (Abramson et al., 2002, 1989, 1978). If they attribute their present lack of control to some *internal* cause (some deficiency in themselves) that is both *global* (a deficiency that is wide-ranging) and *stable* (a deficiency that will continue for a long time), they may well feel helpless to prevent future negative outcomes and they may experience depression. If they make other kinds of attributions, this depressed reaction is unlikely.

Image Source/Getty Images

Breaking up is hard to do **Having your significant other break up with you can be devastating. According to the attribution-helplessness theory, if a person attributes the breakup to their own internal shortcomings rather than to more specific events, the breakup could cause depression.**

Consider a university student whose girlfriend breaks up with him. If he attributes this loss of control to an internal cause that is both global and stable—"It's my fault [internal]; I ruin everything I touch [global], and I always will [stable]"—he then has reason to expect loss of control in the future and may generally experience a sense of helplessness. According to the attribution-helplessness view, he is a prime candidate for depression. If the student instead

attributes the breakup to causes that are more specific ("The way I've behaved the past couple of weeks blew this relationship"), unstable ("I don't usually act like that"), or external ("She never did know what she wanted"), he might not expect to lose control again and would probably not experience helplessness and depression (see photo).

Negative Thinking

Like Seligman, Aaron Beck believes that negative thinking plays a key role in depression. Beck, however, points to *dysfunctional attitudes*, *errors in thinking*, the *cognitive triad*, and *automatic thoughts* as the keys to the clinical syndrome (Beck & Bredemeier 2016; Beck & Haigh, 2014; Beck & Weishaar, 2011; Beck, 2002, 1991, 1967).

Beck believes that some people develop *dysfunctional attitudes*, such as "My general worth is tied to every task I perform," and "If I fail, others will feel repelled by me." In addition, Beck believes that those same people often commit errors in their thinking, such as arbitrary inferences or magnification.

According to Beck, this steady onslaught of dysfunctional attitudes and illogical thinking eventually triggers extended rounds of negative thinking in these individuals. The thinking typically takes three forms and is therefore termed the **cognitive triad**: the individuals repeatedly interpret: (1) *their experiences*, (2) *themselves*, and (3) *their futures* in negative ways that lead them to feel depressed. That is, depressed people interpret their experiences as burdens that repeatedly defeat or deprive them. They view themselves as undesirable, worthless, and inadequate. And they regularly see the future as bleak, as seen in **Figure 15.2**.

> **cognitive triad** a pattern of thinking in which individuals repeatedly interpret their experiences, themselves, and their futures in negative ways that lead them to feel depressed.

Finally, depressed people experience **automatic thoughts**, a steady train of unpleasant thoughts that keep suggesting to them that they are inadequate and that their situation is hopeless. Beck labels these thoughts "automatic" because they seem to just happen, as if by reflex. In the course of only a few hours, depressed people may be visited by hundreds of such thoughts: "I'm worthless. . . . I let everyone down. . . . Everyone hates me. . . . My responsibilities are overwhelming. . . . I've failed as a parent. . . . I'm stupid. . . . Everything is difficult for me. . . . Things will never change."

> **automatic thoughts** specific upsetting thoughts that arise unbidden.

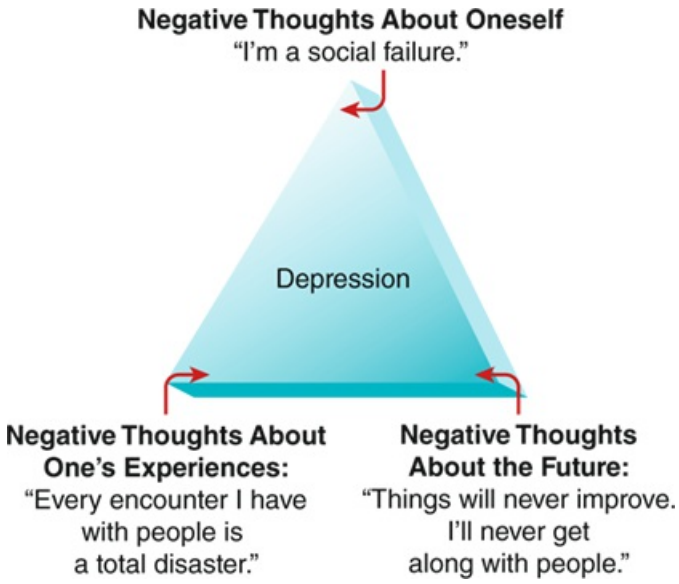


FIGURE 15.2 Cognitive triad of depression **According to Aaron Beck, a regular pattern of these three types of negative thoughts increases vulnerability to depression.**

While it is not entirely clear whether this sort of negative thinking is a cause or a symptom of depression, Beck's explanation has received considerable research support. Several studies confirm, for example, that depressed people hold dysfunctional attitudes, and the more dysfunctional attitudes they hold, the more depressed they tend to be (Qin et al., 2020). Other research supports the theory of a cognitive triad in depressed individuals. For example, studies indicate that depressed participants recall unpleasant experiences more readily than positive ones, rate themselves lower than non-depressed subjects do, and select pessimistic statements in storytelling tests (for example, "I expect my plans will fail") (Bianchi et al., 2018).

More recent research has identified an early framework for the neurobiological underpinnings for Beck's cognitive theory (Beck & Bredemeier, 2016; Belzung, Willner, & Philippot, 2015). This research suggests bottom-up activation from subcortical structures involved in emotional control that are unchecked by top-down cognitive processes from the frontal cortex. In other words, a heightened emotional response cannot be regulated. Research that integrates knowledge across various levels of analysis is helping to move the field not only toward a better understanding of etiology, but also toward a better understanding of treatment options.

How Do Socio-Cultural Theorists Explain Depression?

Socio-cultural theorists propose that social forces play an important role in the development of major depressive disorder. Their belief is supported by the finding, discussed earlier, that depression is often triggered by outside stressors. In addition, the unavailability of social support seems to play a significant role in the onset of depression. People who are separated or divorced display three times the depression rate of married or widowed persons, and double the rate of people who have never been married (Brown & Harris, 2012; Assari, 2017; Neitzke, 2016; Brown, 2010). A poignant example of the

potential impact of social forces are the experiences of Indigenous Canadians with residential schools. The individual and transgenerational traumas associated with residential school experiences are associated with many issues including higher rates of suicidal ideation (see Indigenous Experiences 15.1).

15.1 Indigenous Experiences

Suicide Ideation and Attempts and Residential School Familial History

Antonette White recalls a suicide at her Kuper Island residential school in Chemainus, British Columbia. All students were forced to come in and look at the deceased victim. "I remember the one young fellow that hung himself in the gym, and they brought us in there, and showed, showed us, as kids, and they just left him hanging there, and, like, what was that supposed to teach us? You know I'm 55 years old, and I still remember that" (White, 2012, p. 117).

Suicidal behaviour includes suicide ideation (recurrent ideas and thoughts of ending one's life), suicide attempts (an event where one tries to kill one's self), and completed or fatal suicide (where death occurs). Suicide ideation predicts suicide attempts, and suicide attempts predict suicide completions. Suicide behaviour is an indicator of extreme psychological distress, involving intense feelings of hopelessness, anxiety, and depression, and is often accompanied by self-destructive behaviours (McQuaid et al., 2017).

Completed suicide rates are twice as high among Indigenous peoples as they are in non-Indigenous peoples, for all age groups. First Nations people, both on and off reserve, as well as Metis and Inuit people, die by suicide at higher rates than non-Indigenous people. It is, however, important to note that national suicide rates do not necessarily reflect individual communities. For example, in small Indigenous communities, the impact of suicide is often more significant and widespread since many individuals are related and thereby share many adverse environments and experiences. Conversely, other regions or communities may have very low rates of suicide (Kumar & Tjepkema, 2019; Chandler et al., 2003). Nevertheless, there is increasing evidence to support the idea that the high rates of suicide among Indigenous peoples today originated with exposures to historical and intergenerational inequities and unresolved traumas related to colonization and continue due to ongoing injustice and marginalization (Bombay et al., 2014). In particular, outcomes associated with direct or indirect (i.e., intergenerational) residential school experience elevate risk for physical and mental problems (Elias et al., 2012).

Robyn McQuaid, at Carleton University, and colleagues (2017) studied the impact of intergenerational residential school attendance and its relationship to present-day suicide ideation and attempts. Participants identified whether a parent or a grandparent, or both, had attended a residential school (i.e., one or two previous generations). Individuals who attended residential schools themselves were excluded from analyses. The results of the study indicated that: (1) a familial history of

residential school attendance was associated with a significantly higher risk of suicide ideation and attempts compared with Indigenous people without a residential school history; (2) the results for one or two generations of familial involvement did differentially affect suicide behaviours; and (3) familial transmission of suicidal behaviour cannot be completely explained by psychiatric disorders or current levels of distress.

THE CANADIAN PRESS/Justin Tang

Hopeful messages in Inuktitut and English Students from the Nunavut Sivuniksavut attend an annual suicide prevention event in Ottawa. Hosted by the National Inuit Youth Council and Inuit Tapiriit Kanatami, students send messages to celebrate life and to raise awareness about suicide prevention.

It has been suggested that cultural continuity may play an important protective role in suicide prevention for Indigenous people (Chandler and Lalonde, 2019; Mehl-Madrona, 2016). "[Many] First Nations peoples have maintained their cultural knowledge and ways of living in relation to the land and each other, which is grounded in and contributes to their extreme strength, resilience, and capacity for healing and renewal" (McQuaid et al., 2017, p. 428).

Critical Thinking Questions

Why is it important to be sure not to overgeneralize statements regarding suicide rates among Indigenous groups or populations?

How are residential school experiences linked to present-day suicidal ideation and attempts among Indigenous people?

What is cultural continuity and what roles does it potentially play in matters of Indigenous suicide?

Individuals whose lives are isolated and without intimacy are particularly prone to becoming depressed during times of stress (Domènech-Abella, Mundó, Haro, & Rubio-Valera, 2019; Brown, 2010; Kendler, Myers, & Prescott, 2005). Studies conducted in England several decades ago showed that women who had three or more young children,

lacked a close confidante, and had no outside employment were more likely than other women to become depressed after experiencing stressful life events (Brown, 2010; Brown et al., 2005). Studies have also found that depressed people who lack social support remain depressed longer than those who have a supportive spouse or warm friendships (Van Den Brink et al., 2018). These sorts of research findings have contributed to the development of social prescribing in Britain where doctors, with the support of community liaison workers, prescribe social expediences such as gardening or reading clubs to some of their lonely isolated senior patients (Chatterjee, Camic, Lockyer, & Thomson, 2018).

Bipolar Disorder

People with a *bipolar disorder* often describe their lives as an emotional roller coaster. They shift back and forth between extreme moods, experiencing both the lows of depression and the highs of mania. Unlike people sunk in the gloom of depression, those in a state of *mania* experience dramatic and inappropriate elevation in mood. The symptoms of mania span the same areas of functioning—emotional, motivational, behavioural, cognitive, and physical—as those of depression, but mania affects these areas in an opposite way.

Jonathan Hayward/The Canadian Press

Bipolar disorder Margaret Trudeau, ex-wife of former prime minister Pierre Trudeau and mother of current Prime Minister Justin Trudeau, has spoken openly about her struggle with bipolar disorder and has written a book about her experiences called *Changing My Mind*. She is a fierce advocate for mental health in Canada and is engaged in fighting the stigma of mental illness.

In mania, people have active, powerful emotions in search of an outlet. Their mood of euphoric joy or extreme agitation is out of all proportion to the actual events in the

person's life. In the motivational realm, people with mania want constant excitement, involvement, and companionship. Correspondingly, they move quickly and talk rapidly and loudly. In the cognitive realm, individuals with mania usually show poor judgment and planning. Filled with optimism, they rarely listen when others try to slow them down, interrupt their buying sprees, or prevent them from investing money unwisely. They often hold an inflated opinion of themselves, and sometimes their self-esteem approaches grandiosity (for example, an exaggerated belief in their personal importance). Finally, in the physical realm, the individuals feel remarkably energetic. They typically get little sleep, yet feel and act wide awake (Anderson, Haddad, & Scott, 2012).

Surveys from around the world indicate that between 1 and 2.6 percent of all adults suffer from a bipolar disorder at any given time (Ferrari et al., 2016; Grunze, 2015). According to the Canadian Mental Health Association (2014b), 1 percent of Canadians suffer from bipolar disorder (see photo). Nonetheless, bipolar is considered to be one of the most debilitating disorders globally (Magalhaes et al., 2012). According to most studies, bipolar disorders are equally common in women and men and among all socio-economic classes and ethnic groups (Anderson et al., 2012).

Throughout the first half of the twentieth century, the search for the causes of bipolar disorders made little progress. More recently, neuroscience research has produced some promising clues. There is now strong evidence that a combination of gene abnormalities plays a major role in the development of bipolar disorders (Andreassen & Tesli, 2016; Scaini et al., 2020; Grieco & Edwards, 2010; Schulze & McMahon, 2009). Familial, twin, and adoption studies indicate that bipolar disorder is highly heritable (heritability range: 0.85–0.89) (McGuffin et al., 2003). There is also evidence that bipolar disorder may be linked to ion dysregulation and reduced sodium pump activity (Mack et al., 2019; Alda, 2015).

The diathesis-stress model may partially account for the development of bipolar disorder. Although genes and biological factors appear to play key roles, there is growing evidence that stress and certain kinds of environmental events also must occur in order for episodes of bipolar disorder to unfold. Some studies suggest, for example, that major stress must combine with an individual's genetic predisposition for episodes of bipolar disorder to occur, particularly in early episodes (Lex, Bäzner, & Meyer, 2017; Brietzke et al., 2012). Still other studies suggest that certain kinds of positive events (ones involving the attainment of or striving toward goals) are needed for bipolar disorders to unfold in biologically predisposed people. The idea is that individuals predisposed to develop bipolar disorder overreact to the arousal produced by goal-related events and develop the mania-related symptoms of bipolar disorder (Alloy et al., 2011; Bender & Alloy, 2011).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

8. What is learned helplessness, and what is its role in depression?

9. What is the cognitive triad?

10. How does bipolar disorder differ from major depression?

What Do You Think? • Which of the explanations described in this section do you think best explains depression? Why?

Anxiety Disorders

LEARNING OBJECTIVE 4

Describe the various types of anxiety disorders, and explain some causes of these disorders.

Read through the following example of a conversation between a patient named Bob and his doctor, paying particular attention to what Bob says about his feeling of anxiety.

Bob: It's been an awful month. I can't seem to do anything. I don't know whether I'm coming or going. I'm afraid I'm going crazy or something.

Doctor: What makes you think that?

Bob: I can't concentrate. My boss tells me to do something and I start to do it, but before I've taken five steps I don't know what I started out to do. I get dizzy and I can feel my heart beating and everything looks like it's shimmering or far away from me or something—it's unbelievable.

Doctor: What thoughts come to mind when you're feeling like this?

Bob: I just think, "Oh, Christ, my heart is really beating, my head is swimming, my ears are ringing—I'm either going to die or go crazy."

Doctor: What happens then?

Bob: Well, it doesn't last more than a few seconds, I mean that intense feeling. I come back down to earth, but then I'm worrying what's the matter with me all the time, or checking my pulse to see how fast it's going, or feeling my palms to see if they're sweating.

Doctor: Can others see what you're going through?

Bob: You know, I doubt it. I hide it. I haven't been seeing my friends. You know, they say "Let's stop for a beer" or something after work and I give them some excuse—you know, like I have to do something around the house or with my car. I'm not with them when I'm with them anyway—I'm just sitting there worrying. My friend Pat said I was frowning all the time. So, anyway, I just go home and turn on the TV or pick up the sports page, but I can't really get into that either.

Some people suffer such disabling levels of fear and anxiety that they cannot lead a normal life (see photo). Their discomfort is too severe or too frequent; it lasts too long; or it is triggered too easily. These people are said to have an *anxiety disorder*. Anxiety disorders are collectively the most common mental disorders in Canada. In any given year, about 12 percent of the adult population suffers from one or another of the anxiety disorders identified by DSM-5 (Ruscio et al., 2017; Louise, O'Donnell Siobhan, & Jean, 2017; O'Donnell et al., 2016; Kessler et al., 2012).

Stockbyte/Getty Images

Feeling anxious **Anxiety is a normal part of life—everyone feels anxious sometimes. Anxiety becomes a problem when it interferes with a person's ability to participate fully in society.**

There are several kinds of anxiety disorders. Individuals with *generalized anxiety disorder* experience persistent feelings of worry and anxiety. People with *social anxiety disorder* display persistent fears of social or performance situations. People with *phobias* have a persistent and irrational fear of a specific object, activity, or situation. Individuals with *panic disorder* have recurrent attacks of terror. Those with *obsessive-compulsive disorder* feel overrun by recurrent thoughts that cause anxiety or by the need to perform repetitive actions to reduce anxiety. And those with *posttraumatic stress disorder (PTSD)* are tormented by overwhelming intrusive fears about the horrors associated with the traumatizing event—even when the event is long over and they are otherwise safe and well.

Most individuals with one anxiety disorder suffer from a second one as well (Goldstein-Piekarski, Williams, & Humphreys, 2016; Miloyan et al., 2016). In the above example, Bob experiences the excessive worry found in generalized anxiety disorder, as well as the repeated attacks of terror that mark panic disorder.

Generalized Anxiety Disorder

People with **generalized anxiety disorder (GAD)** experience excessive anxiety accompanied by at least three of the following symptoms: restlessness, keyed-up behaviour, fatigue, difficulty concentrating, muscle tension, and sleep problems. These symptoms vary widely from one person to another (see **Figure 15.3**). The incessant worrying causes self-doubt, and the simplest decision represents a risky outcome; for example, worrying about whether to make spaghetti or veggie burgers for dinner.

generalized anxiety disorder (GAD) an anxiety disorder in which people feel excessive anxiety and worry under most circumstances.

Surveys suggest that as many as 4 percent of the North American population have symptoms of GAD in any given year (Ruscio et al., 2017; Bandelow & Michaelis, 2015; Haller et al., 2014). Women diagnosed with the disorder outnumber men by 2 to 1. The leading explanations of generalized anxiety disorder come from the cognitive and neuroscience models.

How Do Cognitive Theorists Explain Generalized Anxiety Disorder?

As with depression, cognitive theorists suggest that generalized anxiety disorder is caused in part by *dysfunctional assumptions*. Aaron Beck argues that people with GAD constantly hold silent assumptions that imply they are in imminent danger—for example, "A situation or a person is unsafe until proven to be safe" or "It is always best to assume the worst" (Beck & Weishaar, 2011; Beck, Emery, & Greenberg, 1985). Similarly, Albert Ellis (2011, 2002, 1962) claimed that people who are generally anxious hold the following "irrational" assumptions in particular:

> "It is a dire necessity for an adult human being to be loved or approved of by virtually every significant other person in his community."
>
> "It is awful and catastrophic when things are not the way one would very much like them to be."
>
> "If something is or may be dangerous or fearsome, one should be terribly concerned about it and should keep dwelling on the possibility of its occurring."
>
> "One should be thoroughly competent, adequate, and achieving in all possible respects if one is to consider oneself worthwhile."
>
> (Ellis, 1962)

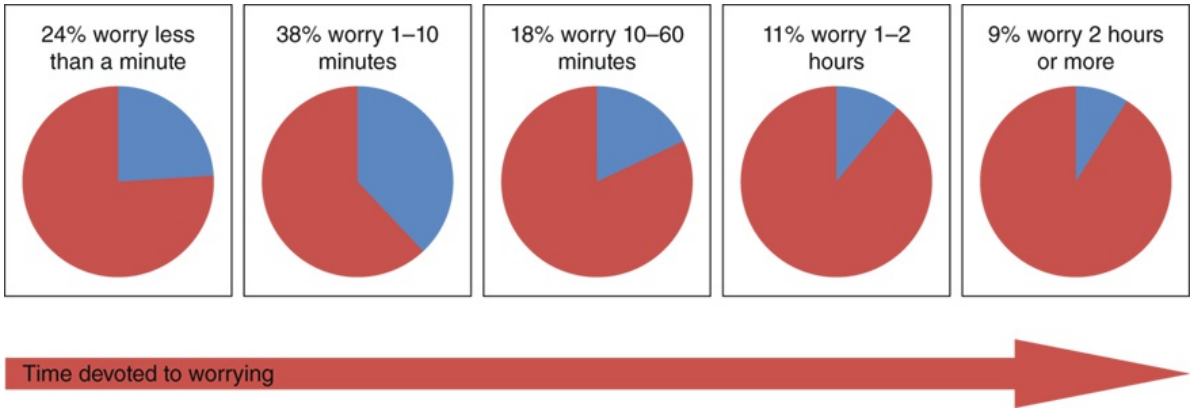


FIGURE 15.3 Some people worry more than others In one survey, 24 percent of post-secondary students said they spend less than 1 minute at a time worrying about something. In contrast, 9 percent worry for more than 2 hours.

Source: Adapted from Tallis, F., Davey, G., & Capuzzo, N. (1994). The phenomenology of non-pathological worry: A preliminary investigation. In G. Davey & F. Tallis (Eds.), *Worrying: Perspectives on theory, assessment and treatment* (pp. 61–89). Chichester, UK: John Wiley & Sons.

In recent years, some additional cognitive explanations for GAD have emerged. Sometimes

called *new wave (or third wave) cognitive explanations*, each of these explanations builds on the notions of Ellis and Beck and their emphasis on perceived danger (DeRubeis, Keefe, & Beck, 2019; Dimidjian et al., 2016; Ritter et al., 2010). According to one such explanation, the *intolerance of uncertainty theory*, certain individuals consider it unacceptable that negative events may occur, even if the possibility of occurrence is very small. Given that life is filled with uncertain events, such individuals may come up against several "unacceptable" events each day. Worrying constantly that unacceptable events are on the verge of happening, the individuals are particularly vulnerable to the development of generalized anxiety disorder (Shihata, McEvoy, Mullan, & Carleton, 2016).

According to this theory, people with GAD keep worrying in an effort to find "correct" solutions to situations at hand, expecting that correct solutions will restore certainty to the situations. However, because they can never really be sure that a given solution is a correct one, they are always left to grapple with intolerable levels of uncertainty, triggering new rounds of worrying and new efforts to find correct solutions. The large jumps in uncertainty for everyone associated with the COVID-19 pandemic definitely complicated things for those intolerant of uncertainty and likely, at least temporarily we hope, tested many more people's tolerance of uncertainty (Koffman, Gross, Etkind, & Selman, 2020).

In support of this theory, studies have found that people with GAD display greater levels of intolerance of uncertainty than people with normal degrees of anxiety (Bottesi et al., 2016; Daitch, 2011; Ouellet, Langlois, Provencher, & Gosselin, 2019; Wright, Lebell, & Carleton, 2016). At the same time, however, recent research indicates that people with other kinds of anxiety disorders may also display high levels of intolerance of uncertainty (Nelson, Hodges, Hajcak, & Shankman, 2015).

How Do Neuroscientists Explain Generalized Anxiety Disorder?

One biological explanation of generalized anxiety disorder focuses on neurotransmitter imbalances. In normal fear reactions, key neurons throughout the brain fire more rapidly, triggering the firing of still more neurons and creating a general state of excitability throughout the brain and body. This state is experienced as fear or anxiety. After neuron firing continues for a while, it apparently triggers a *feedback system*—that is, brain and body activities that reduce the level of excitability. Some neurons throughout the brain release the neurotransmitter *gamma-aminobutyric acid (GABA)*, which then binds to GABA receptors on certain neurons. GABA carries inhibitory messages. That is, when GABA is received at a neuron's receptor, it instructs those neurons to stop firing. The state of excitability is thereby halted, and the experience of fear or anxiety subsides (Rudolph & Moss, 2019).

Some neuroscientists now believe that a malfunction in this feedback system may cause fear or anxiety to go unchecked (Tovote, Fadok, & Lüthi, 2015; Bremner & Charney, 2010). In fact, when some investigators have reduced GABA's ability to bind to GABA receptors, they have found that animal subjects react with heightened anxiety (Skórzewska et al., 2014). This finding suggests that people with generalized anxiety disorder may have ongoing problems in their anxiety feedback system. Perhaps they have too few GABA receptors, or their GABA receptors do not properly capture the neurotransmitter (Li et al., 2016). Benzodiazepines—a class of drugs that reduce anxiety (and will be discussed in greater detail in Chapter 16)—exert their effect by stimulating GABA.

Recent research further clarifies that the root of generalized anxiety disorder is probably more complicated than GABA alone. Other neurotransmitters, such as acetylcholine and serotonin, may also play important roles in GAD as well (Tafet & Nemeroff, 2020; Martin & Nemeroff, 2010). Moreover, emotional reactions of various kinds are tied to brain *circuits*—networks of brain structures that work together, triggering each other into action with the help of neurotransmitters and producing particular kinds of emotional reactions. It turns out that the circuit that produces anxiety reactions includes the *prefrontal cortex*, *anterior cingulate*, and *amygdala*. According to several studies, this circuit may function improperly in people with GAD (Robinson, Pike, Cornwell, & Grillon, 2019; Schienle, Ebner, & Schafer, 2011).

Social Anxiety Disorder

Many people worry about interacting with others or talking or performing in front of others. A number of entertainers, from singer Barbra Streisand to actor Anthony Hopkins, have described major bouts of anxiety before performing. Social fears of this kind are unpleasant and inconvenient, but usually the people who have them manage to function adequately, some at a very high level.

Image Source/Getty Images

Public performances **Most people do not enjoy standing up and presenting in front of a class or group of people. People with social anxiety disorder have particularly intense and irrational fears of not only talking or performing in front of others, but even of just being in regular social situations.**

People with a **social anxiety disorder**, by contrast, have severe, persistent, and irrational fears of social or performance situations in which embarrassment may occur (see photo). The social anxiety may be *narrow*, such as a fear of talking in public or writing in front of others, or it may be *broad*, such as a general fear of functioning poorly in front of others. In both forms, people repeatedly judge themselves as performing less adequately than they actually do.

social anxiety disorder an anxiety disorder in which people feel severe, persistent, and irrational fears of social or performance situations in which embarrassment may occur.

A social phobia can interfere greatly with one's life (Wersebe et al., 2018; Peschard & Philippot, 2016). A person who is unable to interact with others or speak in public may fail to perform important responsibilities. One who cannot eat in public may reject dinner invitations or other social opportunities. Since most people with this phobia keep their fears secret, their social reluctance is often misinterpreted as snobbery, lack of interest, or hostility.

Surveys indicate that at least 7.1 percent of people in Western countries—around three women for every two men—experience social anxiety disorder in any given year. Around 12 percent develop this problem at some point in their lives (Ohayon & Schatzberg 2010; Alfano & Beidel, 2011). It often begins in late childhood or adolescence, and may continue into adulthood. Research finds that people living in poverty are 50 percent more likely than wealthier people to display a social phobia (Bosma, Simons, & Groffen, 2016; Sareen et al., 2011). Moreover, in several studies, minority group participants scored higher than non-minority group participants on surveys of social anxiety (Bandelow & Michaelis, 2015; Goetter et al., 2020).

Lynn Alden and her colleagues at the University of British Columbia explain social anxiety as failure to meet self-determined extreme perfectionistic standards, while simultaneously viewing one's self-efficacy as too low to achieve identified standards in order to meet these high expectations (Alden, Ryder, & Mellings, 2002; Glazier & Alden, 2017). Similarly, Paul Hewitt from the University of British Columbia and Gordon Flett from York University and their colleagues report that socially anxious people tend to be high in perfectionistic self-presentation and cannot allow themselves to make any errors in public (Nepon, Flett, & Hewitt, 2016; Flett & Hewitt, 2014; Hewitt et al., 2003).

The most influential explanations for social anxiety disorder have come from cognitive-behavioural theorists (Benbow & Anderson, 2019; Hofmann & Otto, 2017; Gregory & Peters, 2016). They hold that, like people with generalized anxiety disorder, individuals with this disorder have dysfunctional cognitions that help produce and maintain their symptoms. In the case of social anxiety disorder, those cognitions all centre on the social arena. According to the cognitive-behavioural explanations, people with this disorder hold a cluster of social beliefs and expectations that work against them. These include the following (Gregory, Wong, Marker, & Peters, 2018; Wong et al., 2017; Nordahl & Wells, 2017; Hope et al., 2010):

> They hold unrealistically high social standards and so believe that they must perform perfectly in social situations. Given such standards, they cannot develop social goals that are reasonable and achievable.
>
> They view themselves as unattractive social objects.
>
> They view themselves as socially unskilled and inadequate.
>
> They believe that they are in danger of behaving incompetently in social situations.
>
> They believe that clumsy or inept behaviours in social situations will always lead to terrible consequences.
>
> They believe that they have no control over feelings of anxiety that emerge during social situations.

Cognitive-behavioural theorists contend that, as a result of this cluster of dysfunctional notions, individuals with social anxiety disorder anticipate that social disasters will occur, and so repeatedly perform "avoidance" and "safety" behaviours to help prevent or minimize such disasters (Hofmann & Otto, 2017). Avoidance behaviours include, for example, talking only to familiar persons at meetings or parties. Safety behaviours include holding on to a podium during a classroom presentation so that their hands don't tremble, or wearing makeup to cover blushing. Finally, after a social event has occurred, the individuals keep going over the details of the events in their mind. They overestimate how badly things went and what negative repercussions may unfold. These ruminations serve to keep the events alive, and also feed into the individuals' fears about future social situations (Topper et al., 2017; Hope et al., 2010).

Why do some individuals, and not others, have such dysfunctional cognitions? Researchers have identified a number of factors. These include genetic predispositions, trait tendencies, biological abnormalities, traumatic childhood experiences, and past parent–child interactions (Dias et al., 2016; Brozovich & Heimberg, 2011; Kuo et al., 2011). (See Practically Speaking 15.1.)

15.1 Practically Speaking

Anxious? Take Steps!

Even before the added stresses and uncertainties caused by the COVID-19 pandemic, emerging adults (18- to 28-year-olds) have been experiencing anxiety lately. A survey of over 55,000 Canadian college and university students conducted in the spring of 2019, a year before the pandemic, found that 88 percent of respondents said that in the previous 12 months, they had felt overwhelmed by "all they have to do" at some point and that 69 percent (54 percent of males and 75 percent of females) had "felt overwhelming anxiety" at times (American College Health Association, 2019). These percentages are up significantly compared with similar surveys conducted 5 to 10 years previously (Twenge, 2017; Twenge, Joiner, Rogers, & Martin, 2018). When others describe emerging adults with terms like "sheltered," "coddled," or "fragile," or use nasty names like "snowflake," it is inappropriate and unfair because they ignore the much higher levels of stress and uncertainty in the social and economic world that emerging adults are facing today (Levine, 2020).

This data indicates that the odds are high that you have been challenged by anxiety recently. How are you doing? Have you received any help or support in figuring out how to manage anxiety? Have you tried to help a friend with anxiety issues? Do you know where you can go and what support services or programs you or your friends can connect with that will help with anxiety issues? Here are some things you can do to find out about and connect with some of the many readily available resources that can help you or your friends with anxiety challenges.

> Your college or university will have a number of in-person and online programs and services focused on mental health and wellness, including resources specifically on anxiety. On your college or university's website, use search terms like "wellness," "mental health," "stress," "anxiety," or "resilience," and you should

find several resources that can help with anxiety.

One of the things that most often gets in the way of seeking help is the belief that the anxiety you feel is somehow your fault. Talking to someone about how you feel can help. Alternatively, a good place to start is by answering a few questions about how things have been going for you recently. You can do this online and it can help you decide if you need to talk with someone. A group in British Columbia called HereToHelp, in collaboration with Anxiety Canada, has a confidential online screening tool that can help you gain some clarity and it will provide some suggestions of contacts and possible actions that can help. <www.heretohelp.bc.ca>.

Every province has a number you can call just to talk with someone about how you are feeling but also to find out about programs, supports, and resources in your area. Crisis Services Canada can help you find links to services in your area: <www.crisisservicescanada.ca>.

TheDigitalArtist/Pixabay

Find and use the resources and supports that are available to you—they will really help!

Phobias

As you saw in Chapter 7, a **phobia** (from the Greek for "fear") is a persistent and unreasonable fear of a particular object, activity, or situation. Most phobias fall under the category *specific phobia*, an intense fear of a specific object or situation. See the list of the 10 most common phobias in **Table 15.5**. There are five categories of specific phobia: (1) animals (dogs, cats, snakes, spiders); (2) natural environments (heights, dark, thunder); (3) situations (enclosed spaces, bridges) (see photo); (4) blood and injections; and (5) other (choking, vomiting, loud noises, clowns). People can form a phobia to almost anything (red hair or bald men), but some phobias are more common than others. Surveys suggest that 7.7 percent of people in Canada suffer from at least one specific phobia in any given year (O'Donnell et al., 2016; Kessler et al., 2010).

phobia a persistent and unreasonable fear of a particular object, activity, or situation.

blickwinkel/Alamy Stock Photo

Claustrophobia A fear of enclosed spaces such as elevators is one of the most common phobias.

Behavioural principles provide the leading explanations for specific phobias (Eaton, Bienvenu, & Miloyan, 2018; Gamble, Harvey, & Rapee, 2010). According to behaviourists, *classical conditioning* is one way of acquiring fear reactions to objects or situations that are not really dangerous. Let's say, for example, that a frightening event, such as a lightning strike (*unconditioned stimulus*) naturally elicits a reaction of fear (*unconditioned response*) in an individual. In such a situation, it is possible that a harmless object, such as raindrops (*conditioned stimulus*)—an object that had simply accompanied the frightening event—will come to also elicit a fear reaction (*conditioned response*) in the person. A dated but useful learning theory of phobias is Mowrer's (1950) two-factor theory of phobia learning, which suggests that the fears associated with phobic objects are learned through classical conditioning, while the avoidance behaviours associated with phobias are reinforced through operant conditioning. So, for example, a person might develop a social phobia as a result of a panic attack in a crowd (classical conditioning), and then stop going out to avoid crowds (operant conditioning).

According to behaviourists, another way of acquiring a fear reaction is through *modelling*—that is, through observation and imitation (Bandura & Rosenthal, 1966). A person may observe that others are afraid of certain objects or events and develop fears of those objects or events as well. Consider a young boy whose mother is afraid of illnesses, doctors, and hospitals. If she frequently expresses those fears, before long the boy himself may fear illnesses, doctors, and hospitals. Research has supported the theory that fears can be acquired through classical conditioning or modelling (Wilson, 2011).

TABLE 15.5

10 Most Common Phobias
Sources: Kaskas, Ryan, & Davis, 2017; Van Wagner, 2007; Melville, 1978.

Fear	Phobia Name
Spiders	Arachnophobia
Heights	Acrophobia
Public, social places	Agoraphobia (now included in anxiety disorder)
Social situations	Social phobia (now included in social anxiety disorder)
Flying	Aerophobia
Enclosed spaces	Claustrophobia
Thunder	Brontophobia
Germs	Mysophobia
Cancer	Carcinophobia
Death	Necrophobia

Panic Disorder

Sometimes an anxiety reaction takes the form of an all-consuming, nightmarish panic. Everyone reacts with panic when a real threat occurs and they feel endangered. Some people, however, experience **panic attacks**—periodic, discrete bouts of panic or terror—in the absence of any real threat. These attacks occur suddenly, as a wave of intense fear, reach a peak within 10 minutes, and gradually pass (see photo). Individuals who experience unexpected, repeated panic attacks suffer from **panic disorder**. People who experience these attacks report that they believe they are having a heart attack or losing their mind. Panic disorder is often accompanied by **agoraphobia**, a fear of venturing into public places, especially when alone. Because of their panic attack history, some sufferers of panic disorder develop a fear of travelling to any location where escape might be difficult or help unavailable should panic symptoms develop.

panic attacks periodic, short bouts of panic.

panic disorder an anxiety disorder characterized by recurrent and unpredictable panic attacks that occur without apparent provocation.

agoraphobia a phobia that makes people avoid public places or situations in which escape might be difficult or help unavailable should panic symptoms develop.

geotrac/Getty Images

Panic attack **Many people experience difficulty "catching their breath" during a panic attack, which can lead to hyperventilation.**

Around 4 percent of people in Canada over 15 years of age have suffered from a panic attack at some point in their lives (Canadian Mental Health Association, 2013; Ramage-Morin, 2004). The lifetime rate is highest (5.1 percent) among 45- to 55-year-olds, and lowest (2.5 percent) among those over 55 years of age. Women are nearly twice as likely than men to have experienced a panic attack in any given year (Scott et al., 2018).

As mentioned, neuroscientists have determined that emotional reactions are tied to brain circuits. Panic attacks appear to be produced in part by a brain circuit in the *amygdala*, *hypothalamus*, and *locus ceruleus* (Khalsa et al., 2016; Dresler et al., 2011). Many of today's researchers believe that this brain circuit—including *norepinephrine* and other neurotransmitters—probably functions improperly, producing an excess amount of norepinephrine in people who experience panic disorder (Nardi & Freire, 2016; Noel & Curtis, 2019).

According to cognitive theorists, not only are these individuals hypersensitive to changes in arousal, but once they experience particular bodily sensations, they tend to misinterpret the sensations as signs of a medical catastrophe and fear that the symptoms are signalling that something dire is about to occur (Gellatly & Beck, 2016; Reinecke et al., 2011; Wenzel, 2011a, 2011b). As a result, affected individuals become hypervigilant, fearing the signals

that indicate another attack, ceaselessly monitoring for them, and in so doing increase the likelihood they will experience another.

Obsessive-Compulsive Disorder

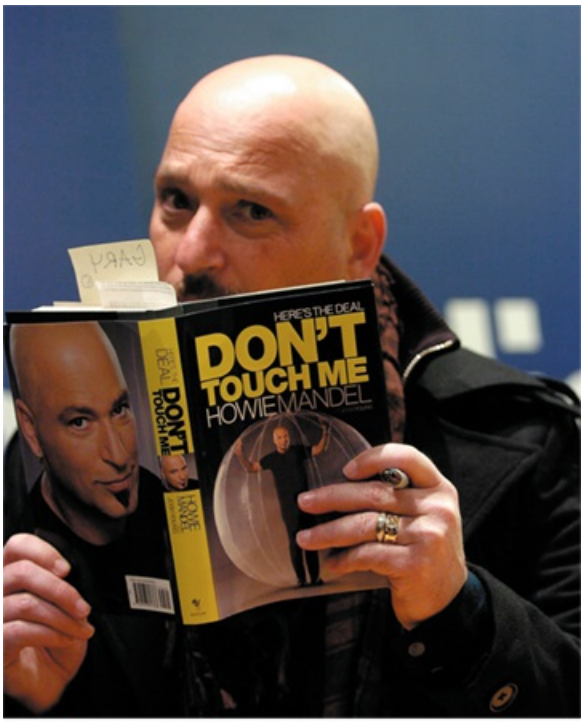
Obsessions are persistent thoughts, ideas, impulses, or images that seem to overrun a person's consciousness. **Compulsions** are repetitive and rigid behaviours or mental acts that people feel compelled to perform to prevent or reduce anxiety. A diagnosis of **obsessive-compulsive disorder (OCD)** is made when obsessions or compulsions are severe; are viewed by the person as excessive, unreasonable, or irrational; cause great distress; consume considerable time; or interfere with daily functions.

> **obsessions** persistent thoughts, ideas, impulses, or images that seem to invade a person's consciousness.
>
> **compulsions** irrational repetitive and rigid behaviours or mental acts that people feel compelled to perform to prevent or reduce anxiety.
>
> **obsessive-compulsive disorder (OCD)** a mental disorder associated with repeated, abnormal, anxiety-provoking thoughts and/or repeated rigid behaviours.

Compulsive acts are typically responses to ward off obsessive thoughts. One study found that in most cases of OCD, compulsions represent a *yielding* to obsessive doubts, ideas, or urges. For example, a woman who has obsessive fears of contamination may yield to that fear by performing cleaning rituals. The study also found that compulsions sometimes serve to *control* obsessions. A man with obsessive images of sexual events, for example, may try to control those images by filling his mind with compulsive verbal rituals, such as repeated expressions, phrases, or chants. In all such instances, the performance of the compulsive acts reduces the anxiety produced by obsessive thoughts.

Two percent of people in Canada suffer from obsessive-compulsive disorder in a given year (Osland, Arnold, & Pringsheim, 2018; Langlois et al., 2011). The disorder is equally common in men and women and among people of different races and ethnic groups (Mathes, Morabito, & Schmidt, 2019).

Obsessions often take the form of obsessive *wishes* (for example, repeated wishes that one's spouse would die), *impulses* (repeated urges to yell out obscenities at work or at a place of worship), *images* (fleeting visions of forbidden sexual scenes), or *doubts* (concerns that one has made or will make a wrong decision). Like obsessions, compulsions take various forms but serve to reduce the anxiety brought about by the obsession. For example, *cleaning compulsions* are very common. People with these compulsions feel compelled to keep cleaning themselves, their clothing, or their homes. The cleaning may follow ritualistic rules and be repeated dozens or hundreds of times a day, making it almost impossible to have a normal life (see photo).



Paul Lapid/The Canadian Press

Obsessive-compulsive disorder **Canadian comedian, game-show host, and author of the book *Don't Touch Me*, Howie Mandel has OCD and an irrational fear of germs (*mysophobia*). He will not shake hands with anyone (including contestants on the game show he used to host, *Deal or No Deal*) because of his fear of contamination.**

How Do Cognitive-Behavioural Theorists Explain Obsessive-Compulsive Disorder?

According to an early cognitive-behavioural theory, people stumble upon their compulsions by chance. In a fearful situation, they happen just coincidentally to wash their hands, say, or dress a certain way. When the threat lifts, they link the improvement to that particular action. After repeated accidental associations, they believe that the action is bringing them good luck or actually changing the situation. As a result, they perform the same action again and again in similar situations. The act becomes a way to avoid or reduce anxiety (Frost & Steketee, 2001).

Another cognitive-behavioural theory focuses on the relationship between obsessions and compulsions and suggests that people learn to perform compulsive acts specifically because such acts reduce the anxiety aroused by their obsessions. According to this theory, some people are generally more inclined than others to experience repetitive, unwanted, and intrusive thoughts, to blame themselves for such thoughts, and to expect that the thoughts can somehow cause terrible things to happen (DeRubeis et al., 2019). To avoid such negative outcomes, they learn to "neutralize" the thoughts—behave in ways meant to put matters right, make amends, and reduce their anxiety.

In support of this cognitive-behavioural explanation, studies have found that people diagnosed with obsessive-compulsive disorder do indeed experience intrusive thoughts

more often than other people, resort to more neutralizing strategies, and experience reductions in anxiety after using neutralizing techniques (Bouvard et al., 2017; Hezel & McNally, 2016). But why do certain people experience more intrusive thoughts in the first place?

How Do Neuroscientists Explain Obsessive-Compulsive Disorder?

The biological explanation of this disorder features two lines of brain research. One points to abnormally low activity of the neurotransmitter serotonin, and the other to abnormal activity in key brain structures.

Some antidepressant drugs help reduce obsessive and compulsive symptoms. Since these drugs also increase serotonin activity, some researchers have concluded that the disorder may be caused by low serotonin activity (Sinopoli, Burton, Kronenberg, & Arnold, 2017; Issaria et al., 2016; Abudy et al., 2012). In another line of research, investigators found a link between obsessive-compulsive disorder and abnormal functioning in specific regions of the brain. Particularly important are the *orbitofrontal cortex*, a region in the prefrontal cortex, and the *caudate nuclei*, structures located within the basal ganglia. These regions are part of a brain circuit that usually converts sensory information into thoughts and actions (Keshavan & Yeragani, 2018). Based on a variety of studies, many neuroscientists have come to believe that one or both of these brain regions are somewhat overactive in certain people, leading to a constant eruption of troublesome thoughts and actions (Ducharme, Dougherty, & Drevets, 2016; Endrass et al., 2011).

Additional parts of this brain circuit have been identified in recent years, including the *thalamus*, the *cingulate cortex*, the *striatum's caudate nucleus,* and, once again, the *amygdala.* It may be that these regions also play key roles in OCD. The serotonin and brain region abnormalities may be linked. It turns out that serotonin plays a very active role in the operation of the orbitofrontal cortex, caudate nuclei, and other structures in the brain circuit. Thus, low serotonin activity might well disrupt the proper functioning of those brain structures. The hypothesis is that the cingulated cortex and hypothalamus activate the OCD impulses that are inhibited though the caudate nucleus, while the amygdala drives the fear and anxiety components of the OCD response (Barrios-Anderson & McLaughlin, 2020).

Posttraumatic Stress Disorder (PTSD)

Stress reactions, and the sense of fear they produce, are often at play in psychological disorders. As you have seen, for example, people who experience a large number of stressful events are particularly vulnerable to the onset of depression. In addition, stress plays a more central role in *acute stress disorder* and *posttraumatic stress disorder* (*PTSD*).

Symptoms of Acute Stress Disorder and Posttraumatic Stress Disorder

Chapter 14 described the roles of the *autonomic nervous system (ANS)* and the *hypothalamic-pituitary-adrenal (HPA)* axis during everyday stress reactions. If people experience a threatening situation where they witness a death or there is the threat of death or injury or sexual violence, they experience levels of arousal, anxiety, and depression that are far beyond those experienced with everyday stress reactions. For

example, Canadian soldiers who served in Afghanistan and residents of Quebec City who were close to a fatal shooting at a mosque are all candidates for PTSD (see photos).

(left) Printed by permission of Random House Canada (right) Ryan Remiorz/ZUMA Press/Newscom

Many events can produce PTSD **Roméo Dallaire wrote about his experiences as Canada's highest ranking officer in Rwanda in his book *Shake Hands with the Devil: The Failure of Humanity in Rwanda* (left). Dallaire, a retired Canadian senator, is working to raise awareness of the atrocities of war and of PTSD. The shootings at a Quebec City mosque in January 2017 (right) shocked Canadians and put those close to it at risk for symptoms of PTSD.**

For most people, the panic reactions subside soon after the danger passes. But for others, the feelings of anxiety and depression, as well as other symptoms, persist well after the overwhelmingly distressful situation is over. These people are suffering from *acute stress disorder* or *posttraumatic stress disorder*, patterns that arise in reaction to a psychologically traumatic event with life-threatening implications, such as witnessing a murder, combat, rape, earthquake, airplane crash, or traffic accident.

If the lingering stress symptoms begin within four weeks of the traumatic event and last for less than a month, a diagnosis of **acute stress disorder** is made (APA, 2013). If the symptoms continue longer than a month, a diagnosis of **posttraumatic stress disorder (PTSD)** is given. The symptoms of PTSD may begin either shortly after the traumatic event or months or even years afterward (Waller et al., 2016). Studies indicate that many cases of acute stress disorder develop into PTSD (Bryant, 2018; Haag, Robinaugh, Ehlers, & Kleim, 2017). Aside from the differences in onset and duration, the symptoms of acute stress disorder and PTSD are almost identical. The individuals experience high levels of ongoing anxiety and depression. They may feel overly alert (hyper alertness), be easily startled, have trouble concentrating, and develop sleep problems (Friedman, 2015; Ruzek et al., 2011). They may also feel extreme guilt because they survived the traumatic event while others did not.

acute stress disorder an anxiety disorder in which fear and related symptoms are experienced soon after a traumatic event and last less than a month.

posttraumatic stress disorder (PTSD) an anxiety disorder in which fear and related symptoms continue to be experienced long after a traumatic event.

In addition, people with stress disorders may be besieged by recurring thoughts, memories, dreams, or nightmares connected to the traumatic event (Birkeland & Heir, 2017). They typically avoid all activities that remind them of the event and try to ignore related thoughts, feelings, or conversations. Affected individuals often also feel detached from other people or lose interest in activities that once brought enjoyment. They may feel dazed and have trouble remembering things (Keane, Marx, Sloan, & DePrince, 2014).

Michael Anton Van Ameringen, at McMaster University, and his colleagues conducted an incidence study looking at stress disorders in Canada. They found a lifetime PTSD prevalence of 9.2 percent in their Canadian sample, as well as a current (at the time of the survey) incidence of 2.4 percent (Peterlin et al., 2011; Taylor, 2010a, 2010b; Van Ameringen, Mancini, & Patterson, 2011). Women are at least twice as likely as men to develop stress disorders: around 20 percent of women who are exposed to a serious trauma may develop one, compared to 8 percent of men (Olff, 2017). Refugees often struggle with issues related to past traumas though, for some, finding a new home supports Posttraumatic Growth. Find out about this in Positive Psychology 15.2.

What Causes a Stress Disorder?

Clearly, extraordinary trauma can cause a stress disorder. The stressful event, however, is not the entire explanation. Certainly, anyone who experiences an unusual trauma will be affected by it, but only some people develop acute stress disorder or posttraumatic stress. To more fully explain the onset of these disorders, researchers point to individuals' biological processes, personalities, childhood experiences, social support systems, and cultural backgrounds.

Biological and Genetic Factors Investigators have learned that traumatic events often trigger physical changes in the brain and body that may lead to severe stress reactions and, in some cases, to stress disorders. They have found, for example, abnormal activity of the hormone *cortisol* and the neurotransmitter *norepinephrine* in the urine, blood, and saliva of combat soldiers, rape victims, concentration camp survivors, and survivors of other severe stresses (Duncan, Cooper, & Shen, 2018).

Evidence from brain studies also shows that once a stress disorder begins, individuals experience further biochemical arousal, and this continuing arousal may eventually damage key brain areas, particularly the hippocampus and the *amygdala* (Akiki et al., 2017; Morey et al., 2016).

Personality Some studies suggest that people with certain personalities, attitudes, and coping styles are particularly likely to develop stress disorders (Meyer, La Bash, et al., 2019). Research has also found that people who generally view life's negative events as beyond their control tend to develop more severe stress symptoms after experiencing a stillbirth or live combat than people who feel greater control over their lives (Chung & Reed, 2017; Mikaeili, Einy, & Taghavy, 2018).

Childhood Experiences Investigators have found that certain childhood experiences seem to leave some people at risk for later acute and posttraumatic stress disorders.

People whose childhoods have been marked by poverty appear more likely to develop these disorders in the face of later trauma. So do people whose family members suffer from psychological disorders; who experienced assault, abuse, or catastrophe at an early age; or who were younger than 10 when their parents separated or divorced and therefore have not yet developed the means to cope with such foundational life changes (Schalinski et al., 2016; Murphy et al., 2014).

Social Support It has been found that people whose social and family support systems are weak are also more likely to develop a stress disorder after a traumatic event. Rape victims who feel loved, cared for, valued, and accepted by their friends and relatives recover more successfully than do those without those supports (Bryant-Davis et al., 2015; Uchino & Birmingham, 2011). So do those treated with dignity and respect by the criminal justice system (Patterson & Tringali, 2015; Patterson, 2011).

15.2 Psychology Around Us | Positive Psychology

Posttraumatic Growth and Canadian Refugees

As you have read in several places in this textbook, posttraumatic stress disorder (PTSD) is real, and can be a very debilitating disorder that can impact people for the rest of their lives after the triggering event. Researchers have shown for decades that PTSD is a challenge for refugees to cope with and try to overcome once they are in locations of relative safety, regardless of where they live (Ahmad, Othman, & Lou, 2019; Reavell & Fazil, 2017; Ssenyonga, Owens, & Olema, 2013). In the last decade, attention has been focused on the mental health of child and adult refugees who have resettled in Canada. We know that factors such as providing community support to refugees, preventing discrimination against them, and giving them a sense of safety are critical for coping with the PTSD they often experience from the traumas of living in often war-torn countries, escaping their countries of origin, and settling in a new, unfamiliar, country.

While PTSD has been well-documented in the literature on refugee mental health, another phenomenon, called posttraumatic growth (PTG), can also occur in some refugees, especially when they can make logical sense of their trauma experiences. The reflection of some refugees on the process of resettlement can lead to intra- and interpersonal gains, and these gains are influenced by their personality traits, such as optimism, their coping style, and positive community support (Chan, Young, & Sharif, 2016). Improvements in mental health function, and PTG in refugees, depends on the support we give our refugees as they adjust to Canadian society, schools, and places of employment (Walker & Zuberi, 2020). It may be that these individuals' PTG—their outlook of hope and their resilience—will be the most important factor for their personal success and for combatting the PTSD they may be experiencing (Tweedie, Belanger, Rezazadeh, & Vogel, 2017).

George Rose/Getty Images

Refugees Can Experience Posttraumatic Growth **Many refugees who have experienced past trauma can, once they get resettled, experience Posttraumatic Growth and thrive in their new location.**

Many of these factors associated with PTSD can clearly be seen in the lives and circumstances of members of the Canadian military returning home from service abroad (Watkins, Sudom, & Zamorski, 2016). In March 2001, in what may have been a suicide attempt, Corporal Christian McEachern drove his SUV directly into the headquarters building at CFB Edmonton. Corporal McEachern had served with Canada's peacekeeping forces in Croatia and Uganda and had been diagnosed with PTSD upon his return. He was eventually tried for this action and found guilty, but was given no jail time. His complaint about the lack of proper services for Canadian Armed Forces members struggling with PTSD was investigated by Canada's parliamentary ombudsman. The ombudsman found that many cases of PTSD among Canada's military personnel were going unidentified and untreated (Marin, 2001). A follow-up report in 2008 found that 18 of the 31 recommendations in the original report had not yet been implemented (McFadyen, 2008). There are simply not enough treatment providers to meet the needs of veterans who struggle with PTSD in Canada (MacLeod & Leduc, 2019; Brewster, 2012). (See Indigenous Experiences 15.2.)

15.2 Indigenous Experiences

Multigenerational and Intergenerational Trauma

Multigenerational and *intergenerational trauma* occurs when untreated trauma-related stress is passed from survivors to members of their families in successive generations. Typically, intergenerational trauma occurs in a family where damaging emotional neglect and abuse traumatized either or both of a parent or grandparent but was not resolved in that generation. As a consequence, when these individuals became parents, these collective experiences began to accumulate and subsequent generations

of the family came to understand, cope with, and heal (or fail to heal) from the original trauma or ensuing trauma(s) (FCSS, 2012).

In Canada, historical injustice and oppression against Indigenous peoples has a long and grim history and encompasses the residential school experience which, as we now know, was largely designed to force assimilation, break the bonds between children and their families, and abolish Indigenous cultures. Thus, one of the legacies of the residential school system has been systemic, intergenerational trauma, in the form of ongoing mental and physical health issues, loss of identity, systemic racism, bigotry and discrimination, family dysfunction, poverty, addiction, incarceration, and cultural breakdown. On an individual level, as discussed throughout the text, many survivors of the residential school system suffered trauma while in residential schools as children and continue to suffer from a broad range of mental and physical health issues as a result of that trauma (Gone et al., 2019; McQuaid et al., 2017). These issues are in turn amplified or distorted over subsequent generations as maladaptive patterns of behaviours the survivors used to protect themselves from the abuse they suffered become entrenched and are then passed down to their own children and grandchildren, often unconsciously (Igloliorte, 2010). George Amato, who attended the St. Bernard school in Alberta, says, "How are we supposed to know how to be a parent when you don't have guidance from anybody? All I had in me all my life was anger" (Truth and Reconciliation Commission of Canada, 2012, p. 79).

Trauma is subjective and results from circumstances that outweigh a person's ability to cope. Thus, responses to seemingly similar devastating events are highly individualistic. In some cases, children were able to remain resilient, in spite of very traumatizing circumstances. Take Lillian Elias. She attended a Residential School in Aklavik, Northwest Territories from the time she was about eight years old. From the outset, she secretly maintained her Inuvialuktun language, which helped her to maintain ties with her culture and her home. She says, "I always say that your culture, your language, tradition, if you have those three you feel good about yourself" (Igloliorte, 2010, p. 58). A resilient survivor, she and her husband kept their own children out of the schools. "My children never stepped in a Residential School because their father wouldn't let them. He was there too long" (p. 55). Other survivors may not be able to begin the process of healing until they are adults, but then begin to recognize the fear and shame, rebuild their family systems, and address the cultural losses stemming from their residential school experiences. When Velma Page was asked in what ways she felt residential schooling may have affected her as a mother, she replied, "A lot of ways. I never learnt how to be friendly or have friends… But I don't see none of my kids. They don't phone or want to visit me… I guess that's the way I brought them up and now I've learned that's the way they are" (Legacy of Hope Foundation, 2020). Culturally appropriate ways to heal these intergenerational rifts are being developed and will be addressed in the next chapter.

REUTERS/Ben Nelms

Recognizing the impact of intergenerational trauma **Residential school survivors are honoured in a walk by First Nations members in Vancouver, British Columbia.**

Critical Thinking Questions

What do multigenerational and intergenerational trauma involve and how are they related to residential school experiences?

How are individual residential school experiences related to trauma in subsequent generations and why do these impacts vary across individuals?

What sorts of factors are involved in coping and resilience among residential school survivors and their own children?

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

11. What are six types of anxiety disorder?

12. How and why might generalized anxiety disorder be related to uncertainty?

13. What role do conditioning and modelling play in the development of phobias?

14. What individual factors affect who will develop posttraumatic stress disorder?

What Do You Think? • The return home for many soldiers is often difficult. One of the problems they face is trying to find a way to talk about their experiences with friends and relatives; if you haven't experienced war, there's really no way to understand what soldiers go through. What sorts of things can we do to make the return home easier for Canadian soldiers?

Schizophrenia

LEARNING OBJECTIVE 5

Describe the features of schizophrenia and some theories of what causes it.

Schizophrenia is a psychotic disorder in which people deteriorate into a world of distorted perceptions, disturbances in thoughts, emotions, behaviours, and experience motor abnormalities. People with this disorder experience **psychosis**, a loss of contact with reality. Their ability to perceive and respond to the environment becomes so disturbed that they may not be able to function at home, with friends, in school, or at work. They may have *hallucinations* (false sensory perceptions) or *delusions* (false beliefs), or they may withdraw into a private world. Psychosis is most commonly associated with schizophrenia, but a number of other disorders may feature psychotic symptoms, such as bipolar disorder or postpartum depression.

schizophrenia a mental disorder characterized by disorganized thoughts, lack of contact with reality, and sometimes hallucinations.

psychosis loss of contact with reality.

Approximately 1 of every 100 people in the world suffers from schizophrenia during his or her lifetime. Equal numbers of men and women receive this diagnosis (Riecher-Rössler, Butler, & Kulkarni, 2018). Almost 3 percent of all those who are divorced or separated suffer from schizophrenia over the course of their lives, compared with 1 percent of married people and 2 percent of people who remain single (Miller & Mason, 2011).

Victor de Schwanberg/Science Source

Hallucinations **Hallucinations are one positive symptom of schizophrenia.**

According to the DSM-5, schizophrenia is diagnosed when a minimum of two symptoms appear continuously for one month and last for six months or more. The symptoms of schizophrenia can be grouped into three categories: *positive symptoms*, *negative symptoms*, and *cognitive symptoms. Psychomotor symptoms* are also often considered in diagnosis. What is it like to drift into psychosis? Rachel Aviv wrote a compelling article on peoples' experiences with their own and close others' schizophrenia symptoms for *Harper's* magazine. You can read the article here: www.columbia.edu/cu/neuwrite/pubs/avivHarpers.pdf.

Positive Symptoms of Schizophrenia

Positive symptoms are "pathological excesses," or bizarre additions, to a person's behaviour and are not seen in people who do not have the disorder. *Delusions*, *disorganized thinking and speech*, *hallucinations*, and *inappropriate affect* are the ones most often found in schizophrenia (see photo).

> **positive symptoms** in the case of schizophrenia, symptoms that seem to represent pathological excesses in behaviour, including delusions, disorganized thinking and speech, hallucinations, and inappropriate affect.

Delusions are false beliefs that are resistant to reason or contradictory evidence, but are maintained in spite of their irrationality. *Delusions of persecution* are the most common delusions in schizophrenia (APA, 2013). People with this delusion believe they are being plotted or discriminated against, spied on, slandered, threatened, attacked, or deliberately victimized. Delusions of identity also occur; for example, the person with schizophrenia believes that he or she is Jesus Christ or Winston Churchill. People with *delusions of grandeur* often believe that they have some special talent or that they are privy to secret knowledge (for example, they have the ability to fly or know that the United States is planning to infiltrate Canada).

> **delusions** blatantly false beliefs that are firmly held despite evidence to the contrary.

People with schizophrenia may also exhibit *disorganized thinking and speech*. Many, for example, display **loose associations**, or **derailment**: they rapidly shift from one topic to another, believing that their incoherent statements make sense. One man with schizophrenia, asked about his itchy arms, responded:

> *The problem is insects. My brother used to collect insects. He's now a man 5 foot 10 inches. You know, 10 is my favourite number. I also like to dance, draw, and watch television.*

> **loose associations** or **derailment** a common thought disorder of schizophrenia, characterized by rapid shifts from one topic to another.

Individuals with schizophrenia may also experience **hallucinations**, perceptions that occur in the absence of external stimuli. People who have *auditory hallucinations*, by far the most common kind in schizophrenia, hear sounds and voices that seem to come from outside their heads (APA, 2013).

> **hallucinations** imagined sights, sounds, or other sensory events experienced as if they were real.

Yet another positive symptom found in schizophrenia is *inappropriate affect*, emotions that are unsuited to the situation. The individuals may smile when making a serious statement or on being told terrible news, or they may become upset in situations that should make them happy. They may also undergo inappropriate shifts in mood.

Negative Symptoms of Schizophrenia

Negative symptoms are those that seem to be "pathological deficits," characteristics that are lacking in an individual but that are seen in individuals without the disorder. *Poverty of speech*, *flat affect*, *loss of volition*, and *social withdrawal* are commonly found in schizophrenia.

> **negative symptoms** in the case of schizophrenia, symptoms that seem to reflect pathological deficits, including poverty of speech, flat affect, loss of volition, and social withdrawal.

Poverty of speech refers to a reduction in speech or speech content. Some people with this negative symptom think and say very little. Others say quite a bit but still manage to convey little meaning. In another negative symptom, *flat affect*, individuals show very little anger, sadness, joy, or other feelings. The faces of these persons are still, their eye contact poor, and their voices monotonous.

Still other persons experience *avolition*, or apathy. They feel drained of energy and interest in normal goals and are unable to start or follow through on a course of action. And, in yet another negative symptom, people with this disorder may *withdraw* from their social environment and attend only to their own ideas and fantasies. Because their ideas are illogical and confused, withdrawal helps distance them still further from reality (Galderisi, Mucci, Buchanan, & Arango, 2018; Marder & Galderisi, 2017; Leucht & Davis, 2017).

Grunnitus Studio/Science Source

Catatonic posturing **Some people struggling with schizophrenia demonstrate catatonic posturing, where they strike and hold bizarre positions, sometimes for hours.**

Cognitive Symptoms of Schizophrenia

Cognitive impairment is a core feature of schizophrenia and affects most individuals diagnosed with the disorder. Affected cognitive functions include memory, executive function, attention, working memory, and intelligence. Undetected cognitive deficits exist and generally pre-date diagnosis of the illness (Seccomandi et al., 2020). Social and functional outcome is related to the degree of cognitive impairment (Green, Horan, & Lee, 2019). Cognitive deficits are related to brain tissue changes and are consequently permanent, persisting even during symptom remission; it is therefore imperative that

patients remain on their antipsychotic medications (Nuechterlein et al., 2013).

Psychomotor Symptoms of Schizophrenia

People with schizophrenia sometimes experience unusual *psychomotor symptoms*—they may move awkwardly or make odd grimaces and gestures. The gestures often seem to have a private, perhaps ritualistic, purpose. The psychomotor symptoms may take extreme forms, collectively called **catatonia**. People in a *catatonic stupor*, for example, stop responding to their environment, remaining motionless and silent for long stretches of time. Others exhibit *catatonic rigidity*, maintaining a rigid upright posture for hours and resisting efforts to be moved. Still others display *catatonic posturing*, assuming awkward, bizarre positions (a squatting position, for example) for long periods of time (see photo). They may even exhibit *waxy flexibility*, in which they maintain indefinitely postures into which they have been placed by someone else (Weinberger & Harrison, 2011).

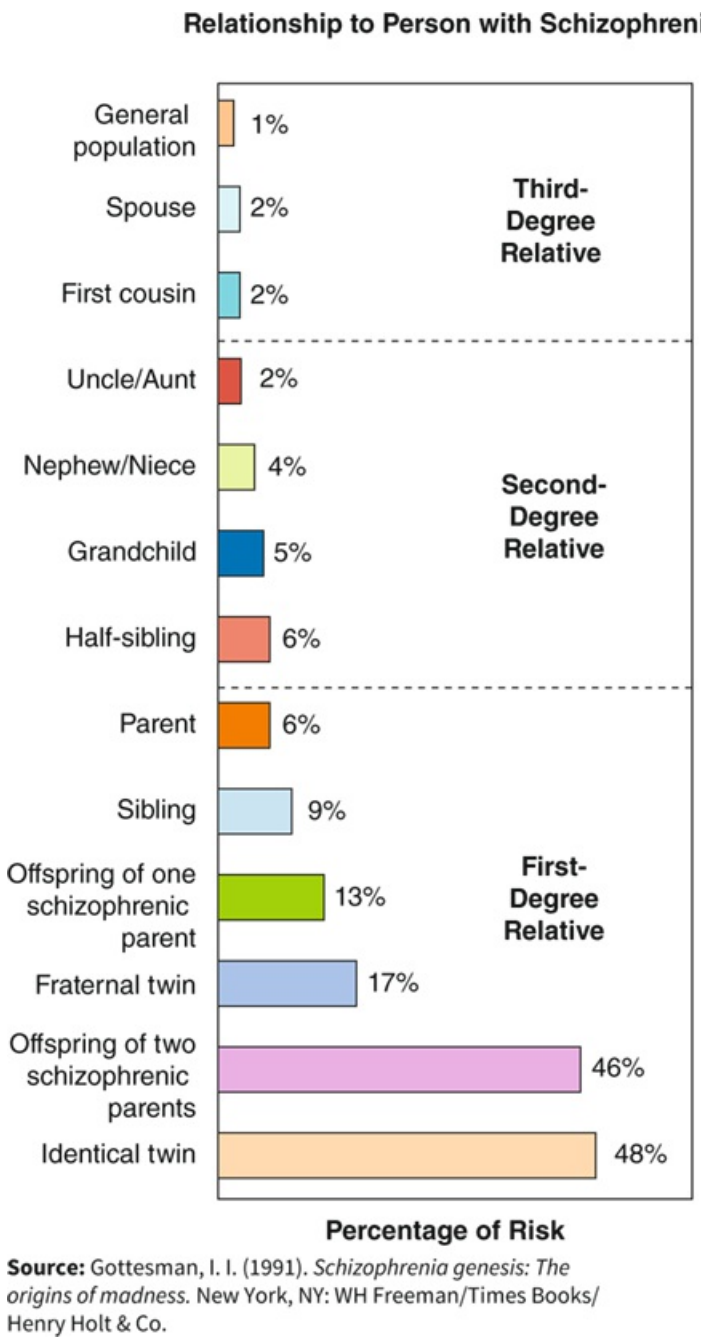
> **catatonia** extreme psychomotor symptoms of schizophrenia, including catatonic stupor, catatonic rigidity, and catatonic posturing.

How Do Neuroscientists Explain Schizophrenia?

Biological explanations of schizophrenia have received the most research support. This is not to say that psychological and socio-cultural factors play no role in the disorder. Rather, it has been hypothesized that a diathesis-stress relationship may account for the development of schizophrenia: perhaps people with a biological predisposition develop schizophrenia only if certain kinds of psychological events, personal stress, or societal expectations are also present.

Genetic Factors

Many theorists believe that people inherit a genetic predisposition to schizophrenia (Swathy & Banerjee, 2017; Leo, 2016; Akbarian, 2010). In support of this notion, studies have found repeatedly that schizophrenia is more common among relatives of people with the disorder than among other individuals (Lo, Kaur, Meiser, & Green, 2020). The more closely related the relatives are to the person with schizophrenia, the greater their likelihood of developing the disorder (see **Figure 15.4**).



Source: Gottesman, I. I. (1991). *Schizophrenia genesis: The origins of madness.* New York, NY: WH Freeman/Times Books/ Henry Holt & Co.

FIGURE 15.4 Family connections and schizophrenia **Biological relatives of people with schizophrenia have a higher risk than the general population of developing the disorder during their lifetimes. Closer relatives (who have a more similar genetic makeup) have a greater risk than more distant relatives.**

Researchers have been particularly interested in twins. If both members of a pair of twins have a particular trait, they are said to be *concordant* for that trait. Therefore, if genetic factors are at work in schizophrenia, identical twins (who share most genes) should have a higher concordance rate for this disorder than *fraternal twins* (who share only about 50 percent of their genes). This expectation has been supported by research (Hilker et al.,

2018; Kläning et al., 2016; Higgins & George, 2007). Studies have found that if one identical twin develops schizophrenia, there is a 48 percent chance that the other twin will also develop schizophrenia at some point in his or her life. If the twins are fraternal, on the other hand, the second twin has approximately a 17 percent chance of developing the disorder. Considerable evidence suggests also that infection in the prenatal and perinatal environments plays an important role in the etiology of schizophrenia (Rubesa, Gudelj, & Makovac, 2018).

How might genetic factors lead to the development of schizophrenia? Research has pointed to two kinds of brain abnormalities that may be inherited—*biochemical abnormalities* and *abnormal brain structures*.

Biochemical Abnormalities

Over the past four decades, researchers have developed the *dopamine hypothesis* to help explain schizophrenia. The first clue that high dopamine activity may contribute to schizophrenia came with the accidental discovery in the 1950s of **antipsychotic drugs**—medications that help remove the symptoms of schizophrenia (Garver, 2006; Healy, 2005). Originally used as anesthetics during surgery, the early drugs were found to also calm agitated psychotic patients. Direct tests followed, and a revolution in the treatment of schizophrenia began (Ban, 2007).

antipsychotic drugs medications that help remove the symptoms of schizophrenia.

The dopamine hypothesis proposes a dysregulation or imbalance of dopamine with a hyperactive (overactive) subcortical transmission resulting in positive symptoms, and a hypoactive (underactive) cortical transmission to prefrontal cortex resulting in cognitive impairments and negative symptoms (Howes et al., 2017; Gründer & Cumming, 2016; Edwards et al., 2016). This hypothesis has undergone challenges and adjustments in recent years, but it is still the foundation for present biochemical explanations of schizophrenia. Additional studies further suggest that abnormal activity of the neurotransmitters glutamate and serotonin may also play a role in schizophrenia (Stahl, 2018; Gillespie et al., 2017).

Abnormal Brain Structures

During the past decade, researchers have also linked many cases of schizophrenia to abnormalities in brain structure (Nelson et al., 2017; Birur, Kraguljac, Shelton, & Lahti, 2017; Brugger & Howes, 2017). Using brain scans, for example, they have found that many people with schizophrenia have enlarged ventricles (the brain cavities that contain cerebrospinal fluid), relatively small temporal lobes and frontal lobes, and abnormal blood flow in certain areas of the brain. In addition, some studies have linked schizophrenia to structural abnormalities of the hippocampus, amygdala, and thalamus (Edwin-Thanarajah et al., 2016).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

15. What is a psychosis?

16. What are the positive symptoms of schizophrenia? The negative symptoms? The psychomotor symptoms?

17. What biochemical abnormalities and brain structures have been associated with schizophrenia?

What Do You Think? • We noted in this section that if one identical twin develops schizophrenia, there is a 48 percent chance that the other twin will do so as well. Discuss how this might support the diathesis-stress perspective.

Other Disorders

LEARNING OBJECTIVE 6

Discuss the features and possible causes of somatic symptom and related disorders, dissociative, and personality disorders.

We have now examined three important categories of psychological disorders: mood disorders, anxiety disorders, and schizophrenia. We will conclude the chapter by looking briefly at three additional disorder categories: somatic symptom and related disorders, dissociative disorders, and personality disorders.

Somatic Symptom and Related Disorders

The DSM-5 identifies **somatic** (physical) **symptom and related disorders** as defined by excessive concerns about physical health. Unlike the DSM-IV-TR, where the diagnosis required that the disorders be medically unexplained, the DSM-5 has removed this criterion. The DSM-5 includes somatic symptoms whether they can be medically explained or not. People with somatic symptom and related disorders often seek medical treatment, visiting numerous physicians and taking many different types of medications. Repeated hospitalization and surgeries are common. This behaviour is costly to the individual and to society. Frequently no medical explanation or cure is available to explain their symptoms. Typically these individuals do not consciously want or purposely produce their symptoms; they believe that their problems are genuine and experience the symptoms as completely physical (McGeary et al., 2017; American Psychiatric Association Division of Research, 2013).

> **somatic symptom and related disorders** excessive thought, feelings, and behaviours related to somatic symptoms.

There are five specific diagnoses related to somatic symptom and related disorders: somatic symptom disorder, illness anxiety disorder, conversion disorder (functional neurological symptom disorder), psychological factors affecting other medical conditions,

and factitious disorder.

Zinkevych/Getty Images

Somatic symptoms? People with somatic symptom disorder spend a lot of time seeking medical assistance with symptoms that often elude diagnosis.

Somatic Symptom Disorder

The DSM-5 has three criteria for somatic symptom disorder (SDD): (1) the individual has one or more somatic symptoms that cause distress or significant disruption in their daily life; (2) excessive health-related anxiety and concern, as well as time and energy, are devoted to the somatic complaint; and (3) the concern has lasted for at least six months. For some, pain is of central concern.

Ailments may include pain symptoms (such as headaches and chest pain), gastrointestinal symptoms (such as nausea and diarrhea), sexual symptoms (such as erectile or menstrual difficulties), and neurological symptoms (such as double vision or paralysis). Sufferers may go from doctor to doctor in search of relief (see photo). Some may even seek multiple surgical procedures. They often describe their many symptoms in dramatic and exaggerated terms (Henningsen, 2018; Kurlansik & Maffei, 2016).

Illness Anxiety Disorder

In this disorder, an individual is preoccupied with having a serious disease in spite of the lack of somatic symptoms (Shikatani, Nowakowski, & Antony, 2015). To meet the DSM-5 criteria, the personmust engage in excessive care-seeking for at least six months and engage in excessive illness behaviours. It is important to note that a person must have minimal or no symptoms to meet this diagnosis. If symptoms are present, the person would be diagnosed with somatic symptom disorder.

Conversion Disorder: Functional Neurological Symptom Disorder

In *conversion disorder*, a person develops symptoms suggestive of neurological damage, such as paralysis, seizures, blindness, or loss of feeling. Symptoms may also include muscle tensing, arm or leg twitching, shaking or barking, and other odd behaviours (Levenson &

Sharpe, 2017; Ding & Kanaan, 2017; Nicholson et al., 2016). However, medical tests suggest that the bodily systems and central nervous system are healthy. The symptoms usually appear suddenly, at times of extreme stress, and last a matter of weeks. The disorders are thought to be quite rare, occurring in at most 5 of every 1,000 persons (Abbey, 2005). The affected person appears almost unconcerned by the symptoms.

Conversion disorder is difficult to distinguish from *malingering* (Yakobov, Jurcik, & Sullivan, 2017). When people are malingering, they intentionally lie about symptoms to avoid an unwanted responsibility. This intentionality is not considered a part of conversion disorder. In general, malingers stand to benefit from their "illnesses" in some way (get out of a job or military service, receive a substantial insurance settlement, and so on) and, unlike those with conversion disorder, show an almost exaggerated interest in their symptoms.

Psychological Factors Affecting Other Medical Conditions

In psychological factors affecting other medical conditions, psychological factors affect a documented medical condition in an adverse manner, creating unique health risks (e.g., chronic overeating creating a lack of adherence to a medical protocol for diabetes) or delaying recovery and/or exacerbate (worsen) an existing medical condition (e.g., anxiety triggering asthma attacks).

Factitious Disorder

In factitious disorder, people deliberately assume physical or psychological symptoms to adopt the patient role (Bass & Halligan, 2014). Patients may lie about symptoms or they may actually take steps to make themselves ill, impaired, or injured—swallowing or injecting damaging drugs or substances to become genuinely ill or causing themselves bodily harm in some way. Factitious disorder can also be diagnosed in parents who fabricate illness in their children and then present them as ill, impaired, or injured. In this case the diagnosis is *factitious disorder imposed on another* (or *Munchausen by proxy*). Most cases of factitious disorder imposed on another involve a parent making a child ill; however, the diagnosis would hold in any instance where one person deliberately causes harm to another and then presents the other person as ill and themselves as caregiver.

What Causes Somatic Symptom and Related Disorders?

Although this specific categorization is relatively new, theorists have typically explained somatization disorders much as they explain anxiety disorders (Ferri, 2016; Bouman, 2008; Noyes, 2008). Behaviourists, for example, believe that the fears found in the disorders are acquired through classical conditioning or modelling (Marshall et al., 2007). Cognitive theorists suggest that people with one of these types of disorders are extremely sensitive to bodily cues and come to misinterpret them (Riebel, Egloff, & Witthöft, 2014; Witthöft & Hiller, 2010).

How Do Socio-Cultural Theorists Explain Somatic Symptom and Related Disorders?

Clinicians often use the term *somatization* when referring to the development of somatic symptoms in response to personal distress, the key feature of somatic symptom and related

disorders. Somatization of any kind is considered inappropriate in Western countries (Fritzsche, 2020). Some theorists believe, however, that this position reflects a bias held by Western clinicians—a bias that sees somatic symptoms as an *inferior* (developmentally immature) way of dealing with emotions.

A worldwide view reveals that the transformation of personal distress into somatic complaints is in fact the norm in many non-Western cultures (Koh, 2018; Holster, Hawks, & Ostermeyer, 2017; Kirmayer & Ryder, 2016). In such cultures, somatization is viewed as a socially and medically correct—and less stigmatizing—reaction to life's stressors. Studies have found very high rates of somatization in non-Western medical settings throughout the world, including China, Japan, and Arab countries (Matsumoto & Juang, 2016). Individuals in Latin countries seem to display the greatest number of somatic symptoms (Lanzara, Scipioni, & Conti, 2019; Kleinstäuber & Rief, 2017). Even within North America, people from Hispanic cultures display more somatic symptoms in the face of stress than do other populations. Such findings remind us once again that reactions to life's stressors are often influenced by culture. Overlooking this point can lead to knee-jerk mislabels or misdiagnoses.

Dissociative Disorders

People sometimes experience a major disruption of their memory. They may, for example, lose their ability to remember new information that they just learned or old information they once knew well. When such a change in memory lacks a physical cause, it is called a **dissociative disorder**. Part of a person's cognition or experience is no longer consciously accessible, and this aspect of memory seems to be *dissociated*, or separated, from the rest (Carlson et al., 2018; Wolf et al., 2014; Barlow, 2011). (See photo.) The DSM-5 includes three major dissociative disorders: dissociative amnesia, depersonalization/derealization disorder, and dissociative identity disorder. Although dissociative disorders are often portrayed in novels, movies, and television shows, they are in fact quite rare (Kate, Hopwood, & Jamieson, 2020; Brand & Frewen, 2017).

> **dissociative disorder** a psychological disorder characterized by major loss of memory without a clear physical cause; types include *dissociative amnesia*, *dissociative fugue*, and *dissociative identity disorder*.

GMint/Getty Images

Memory loss **All of us have problems remembering something from time to time, but those with dissociative disorders have major disruptions in memory where one part of their memory seems to be dissociated from the rest.**

Dissociative Amnesia

People with *dissociative amnesia* are unable to recall important information, usually of an upsetting nature, about their lives (APA, 2013). The loss of memory is much more extensive than normal forgetting and is often triggered by a traumatic event, as in wartime and natural disasters (Staniloiu et al., 2020; Staniloiu & Markowitsch, 2014). In most cases, the forgotten material or events eventually return, often without the help of treatment.

The memory loss generally focuses on a particular aspect of a traumatic experience rather than an entire period of time surrounding the event. For example, a person might not be able to recall the death of a child, but would recall other events that happened during that time. Usually dissociative amnesia is characterized by sudden onset of an episode with an equally rapid disappearance.

In a type of amnesia known as *fugue*, memory loss is extensive. People not only forget their personal identities and details of their past lives, but may also flee to an entirely different location. Some individuals travel a short distance and make few social contacts in the new setting (APA, 2013). In other cases, however, the person may travel far from home, take a new name, and establish a new identity, new relationships, and even a new line of work (APA, 2013). It ought to be noted that even for those who experience exceptionally traumatizing events, fugue is rare (Staniloiu & Markowitsch, 2014; Spiegel et al., 2012).

Depersonalization/Derealization Disorder

In depersonalization/derealization disorder, stress alters perceptions. Memory is unaffected, but the person becomes detached from the body and/or the self. Patients report feeling as if they are observing themselves from a vantage point outside the body, or report feeling robotic or viewing parts of their bodies as bizarre and unrelated to themselves. This disorder usually has an onset in adolescence and it can begin suddenly or gradually. Once it begins, it is chronic and can last for decades (Lynn et al., 2015; Hunter, 2013).

Dissociative Identity Disorder

People with *dissociative identity disorder*, previously known as *multiple personality disorder*, develop two or more distinct personalities—called *subpersonalities* or *alternate personalities*—each with a unique set of memories, behaviours, thoughts, and emotions. At any given time, one of the subpersonalities takes centre stage and dominates the person's functioning (Lynn et al., 2015; Barlow, 2011). Cases of dissociative identity disorder were first reported almost three centuries ago (Rieber, 2006, 2002). Women receive this diagnosis at least three times as often as men (APA, 2013).

How Do Psychodynamic Theorists Explain Dissociative Disorders?

A variety of theories have been proposed to explain dissociative disorders. Psychodynamic theorists believe that dissociative disorders are caused by *repression*, the most basic ego defence mechanism. As you read in Chapter 12, psychodynamic theorists believe that people fight off anxiety by unconsciously preventing painful memories, thoughts, or impulses from reaching awareness. Everyone uses repression to a degree, but people with dissociative disorders are thought to repress their memories excessively (Gupta & Kumar, 2018; Howell & Itzkowitz, 2016; Jha & Sharma, 2015). In the psychodynamic view, dissociative amnesia and fugue are *single episodes* of massive repression. In each of these disorders, a person unconsciously blocks the memory of an extremely upsetting event to avoid the pain of facing it. Repression may be their only protection from overwhelming anxiety (Kikuchi et al., 2010).

In contrast, dissociative identity disorder is thought to result from a *lifetime* of excessive repression (Howell & Itzkowitz, 2016; Howell, 2011). Psychodynamic theorists believe that continuous use of repression is motivated by traumatic childhood events, particularly abusive parenting. Children who experience such traumas may come to fear the dangerous world they live in and take flight from it by pretending to be another person who is looking on safely from afar. Abused children may also come to fear the impulses that they believe are the reasons for their excessive punishments. Whenever they experience "bad" thoughts or impulses, they unconsciously try to disown and deny them by assigning them to other personalities (Krüger & Fletcher, 2017; Baker, 2010).

The psychodynamic explanation has failed to receive much research support (Merenda, 2008). Most of the support for the psychodynamic position is drawn from case histories, which report brutal childhood experiences (Becker, Karriker, Overkamp, & Rutz, 2018). Yet some individuals with dissociative identity disorder do not report on abuse in their backgrounds. Moreover, child abuse is more common than dissociative identity disorder. This has left many critics asking why, if the psychodynamic explanation has merit, only a small fraction of abused children develop this disorder.

How Does the Neuroscience Approach Explain Dissociative Disorders?

The biological approach has nothing definitive in this area, but there have been a number of intriguing findings in recent years (Frewen & Lanius, 2015). For example, one study used MRI scans to examine the hippocampus and amygdala of individuals with and without dissociative disorder. Both of these brain regions were found to be significantly smaller in those with dissociative disorder. As well, these same regions have been found to be smaller in individuals with histories of childhood trauma (Fosse, Moskowitz, Shannon, & Mulholland, 2019). Other studies have shown decreased functioning in several emotional processing areas of the brains of individuals struggling with dissociative disorders (Blihar et al., 2020). Finally, PET scans of the brains of individuals with and without dissociative disorders show significant differences in the level of activity in both the sensory cortex and in areas of the brain previously found to be associated with integrated body schemes (Staniloiu, Vitcu, & Markowitsch, 2012). This sort of understanding is the first of many steps toward a complete understanding of the etiology of dissociation.

Personality Disorders

A **personality disorder** is a very rigid pattern of inner experience and outward behaviour. The pattern is seen in most of the person's interactions, continues for years, and differs markedly from the experiences and behaviours usually expected of people. Such disorders typically become recognizable in adolescence or early adulthood, although some seem to start during childhood (Sperry, 2016; Westen, Betan, & Defife, 2011). It has been estimated that as many as 9 to 13 percent of all adults may have a personality disorder (Volkert, Gablonski, & Rabung, 2018; Gawda & Czubak, 2017). Personality disorders are controversial, with many researchers and clinicians arguing that having a difficult personality does not necessarily constitute a disorder. Instead, they argue that personality problems might be better conceptualized as extremes on trait scales, such as the Big Five (Skodol, 2018; Trull & Durrett, 2005).

> **personality disorder** an inflexible pattern of inner experience and outward behaviour that causes distress or difficulty with daily functioning.

This debate became intense as the committee considering revisions to the Personality Disorders section of the *Diagnostic and Statistical Manual* discussed possible changes for the 5th edition of the DSM (Skodol, Morey, Bender, & Oldham, 2013). As we have seen in this chapter, the DSM generally addresses disorders categorically by defining criteria for diagnostic inclusion and then deciding, by applying defined criteria, whether an individual does or does not meet the criteria for diagnostic inclusion in a disorder category. In contrast with this categorical approach, we discussed in Chapter 12 how personality has been defined as a number of continuous dimensions along which individuals might be variably arrayed. In the DSM revision debate, some argued for a *personality* approach to personality disorders that would define personality disorders as patterns of extreme scores on a number of personality dimensions, perhaps related to but going beyond the Big 5 model (Sleep, Weiss, Lynam, & Miller, 2019; Watters & Bagby, 2018; Busch, Morey, & Hopwood, 2017; Wright, 2017). In the end, the categorical approach supports prevailed, arguing that a categorical approach was the one that clinical psychologists, who were

working with personality-disordered clients, were most familiar and comfortable with. As a result, the DSM-5 identifies 10 specific personality disorders that fall into three clusters: (1) odd/eccentric, (2) dramatic/erratic, and (3) anxious/inhibited. (see **Table 15.6**). However, the committee also agreed that a dimensional approach to personality disorders would be identified as a research priority and that the question will be reconsidered when it is time to start working on the 6th edition of the DSM (Skodol et al., 2013). Developments in this area will be very interesting to follow. Only two of the ten categorically defined Personality Disorders, the *antisocial* and *borderline personality disorders*, have been studied extensively, partly because they create so many problems for other people.

Antisocial Personality Disorder

Sometimes described as "psychopaths" or "sociopaths," people with **antisocial personality disorder** persistently disregard and violate others' rights (APA, 2013). Aside from substance-related disorders, this is the disorder most closely linked to adult criminal behaviour. Most people with antisocial personality disorder display some patterns of misbehaviour before the age of 15, including truancy, running away, physical cruelty to animals or people, and destroying property (DeLisi, Drury & Elbert, 2019; Whipp et al., 2019; Hodgins et al., 2018; Black, 2013).

> **antisocial personality disorder** a personality disorder characterized by extreme and callous disregard for the feelings and rights of others.

People with antisocial personality disorder lie repeatedly (Grant et al., 2019). Many cannot work consistently at a job; they are frequently absent and are likely to quit their jobs altogether. They are often careless with money and frequently fail to pay their debts. They are also often impulsive, taking action without thinking of the consequences (Hahn, Simons, & Hahn, 2016). Correspondingly, they may be irritable, aggressive, and quick to start fights.

Recklessness is another common trait: people with antisocial personality disorder have little regard for their own safety or for the safety of others, even their children. They are self-centred, and likely to have difficulty maintaining close relationships. They often have a knack for gaining personal profit at the expense of other people. The pain or damage they cause seldom concerns them; they appear to lack a moral conscience (Larsen, Jalava, & Griffiths, 2020). They think of their victims as weak and deserving of being conned or robbed.

TABLE 15.6

Clusters of Personality Disorders and Characteristic Features
Source: Morcos, N., & Morcos, R. (2016). Personality disorders: A measured response. *The Journal of Family Practice, 65*(2), 90–71.

Cluster/disorder	Features
Cluster A	
Paranoid	Excessive distrust and suspiciousness of others; pathologically jealous; interprets actions as demeaning, malevolent, threatening, or

	exploitative; ideas of reference (believes coincidences or innocuous events have strong personal significance)
Schizoid	Detachment from social interactions without a desire for close interpersonal relationships; restricted affect
Schizotypal	Eccentric beliefs without frank delusions; cognitive and perceptual disturbances; impaired social interactions
Cluster B	
Antisocial	Lack of empathy, with disregard for rights of others; deceitfulness, impulsivity, irresponsibility
Borderline	Unstable self-image; chronic feelings of emptiness; instability of interpersonal relationships; affective instability; self-harm behavior; hypersensitivity to rejection and fear of abandonment
Histrionic	Excessive attention-seeking behavior and emotionality; often excessively impressionistic and shallow
Narcissistic	Need for admiration; grandiosity in speech and behavior; lack of empathy for others, interpersonally exploitative; arrogant and haughty
Cluster C	
Dependent	Inability or extreme difficulty making own decisions; overly reliant on others; submissiveness; feelings of inadequacy; avoidance of confrontation
Avoidant	Feelings of inadequacy; hypersensitivity to rejection; social inhibition despite a desire to form close interpersonal relationships
Obsessive-compulsive	Preoccupation with details and rules; excessive organization; perfectionism, orderliness, miserliness; rigidity and stubbornness

Robert Hare of the University of British Columbia has developed a measure of psychopathy called the Psychopathy Checklist–Revised (PCL-R) (Hare, Neumann, & Mokros, 2018; Hare, 2013, 2003). Hare argues that psychopathy is a more extreme disorder than antisocial personality disorder, and argues that each should be considered separate from the other. The scale provides subscale scores on aggressive narcissism and socially deviant lifestyle. Scores on the scale correlate well with diagnoses of antisocial personality disorder, but the PCL-R is more specific. Hare's data indicate that while about 80 percent of individuals in Canadian prisons would meet the DSM criteria for antisocial personality disorder, only 20 percent would meet the PCL-R criteria for psychopathy (see photo). Further, Hare argues that the 20 percent identified by the PCL-R are responsible for 50 percent of the most serious crimes (Hare, 1993). (See Psychology Around Us 15.3.)

C_FOR/iStock/Getty Images

Psychopathy and crime **Half of all serious and repeat rapists and nearly half of all murderers meet the criteria for psychopathy on Robert Hare's PCL-R scale.**

Beyond Robert Hare's data, there are no general Canadian data available; however, American surveys indicate that as many as 2 to 3.5 percent of people in the United States meet the criteria for antisocial personality disorder (Volkert et al., 2018; Goldstein et al., 2016). It is likely that Canadian numbers are similar. The disorder is as much as four times more common among men than women.

Antisocial personality disordered individuals or perhaps sociopaths are often described as self-interested and driven to succeed and unconcerned about the feelings of others. Perhaps you have had a boss or heard about a corporate CEO (or president) who caused you to wonder if some sociopaths succeed in the business world. That thought has occurred to industrial organizational psychologists as well (Perry & Miller, 2017). What their research suggests fits well with what we have said above about antisocial personality disordered individuals: that the organizational situations where a sociopath might succeed are limited and leaders need much more that a personal desire to succeed. The Psychology@Work video on Leadership and Management: From Sociopaths to World Heroes looks at what else is required of leaders.

Video **PSYCHOLOGY@WORK**

Leadership and Management: From Sociopaths to World Heroes **This video looks at industrial/organizational psychology theory and research on leadership types. The video examines the meme that corporate CEOs might be sociopaths but indicates that this is not supported by data.**

15.3 Psychology Around Us

Not Criminally Responsible on Account of Mental Disorder

How does someone get declared "not criminally responsible on account of mental

disorder," and can people use this to "get away with murder"?

Is it possible for someone who was not clearly diagnosed as disordered before committing a violent act (a potential crime) to be found not responsible for the crime on account of a mental disorder? The concept of insanity, which is used in the U.S. legal system, is not a psychological one; its definition is legal. *Insanity* refers to a condition that excuses people from responsibility and protects them from punishment. From the legal point of view, a person cannot be held responsible for a crime if, at the time of the crime, the person lacked the capacity to distinguish right from wrong in order to obey the law. As Regina Schuller of York University and James Ogloff of Simon Fraser University point out, the Canadian legal outcome of "not criminally responsible on account of mental disorder" is not a diagnosis or even a psychological concept; it is simply a legal finding (Schuller & Ogloff, 2001). If a person is found "not criminally responsible by reason of mental disorder," he is neither convicted nor acquitted, and as such he is not formally sentenced. Instead, a court review board decides on the most appropriate arrangement, which could be an absolute discharge, a discharge with conditions (such as probation and/or treatment or medication), or detention in a hospital or institution.

On July 11, 2014, Bill C-14, the Not Criminally Responsible Reform Act, was passed in Canada. This legislation changed the Criminal Code of Canada regarding individuals found not criminally responsible due to a mental disorder. This bill is intended to enhance the rights of victims of violent crimes by persons found unfit to stand trial and to ensure public safety through tightened conditions for those under the authority of review boards. It also created a new "high risk accused" category. The effort to change the legislation was driven by the parents of Tim McLean, a young man decapitated while sleeping at the back of a Greyhound bus in 2008. The man charged with the murder, Vincent Li, had been previously diagnosed with schizophrenia. He believed God told him that his own life depended on his killing McLean. Li was found not criminally responsible on account of mental disorder. Those in favour of the legislation feel that it has not gone far enough to protect the public. Conversely, 11 Canadian mental health organizations (including the Canadian Psychological Association) have expressed strong disappointment with the legislation, pointing out that it is highly stigmatizing, perpetuates fear of those with mental illness, and diminishes the rights of individuals who are mentally ill (Crocker et al., 2015). It is important to recognize that justice is more than punishment and must be weighed against compassion and mercy.

What Causes Antisocial Personality Disorder?

Although the various models provide a range of explanations for antisocial personality disorder, none has managed to account for the broad range of symptoms found in the disorder. However, the behavioural and neuroscience models offer insights about particular symptoms.

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Rewarding bad behaviour **Research suggests that some parents unintentionally teach antisocial behaviour by regularly rewarding a child's aggressive behaviour. For example, if a child defies a parent and the parent gives in to restore peace, the parent may be unintentionally teaching the child to be stubborn.**

According to a number of behavioural theorists, antisocial symptoms may be learned through modelling (Goulter, McMahon, Pasalich, & Dodge, 2019; Robinson, Azores-Gococo, Brennan, & Lilienfeld, 2016). As evidence, they point to the particularly high rate of antisocial personality disorder found among the parents of people with this disorder (though this could also reflect a genetic aspect of the disorder). Other behaviourists have suggested that some parents unintentionally teach antisocial behaviour by regularly rewarding a child's aggressive behaviour (Kazdin, 2018). When the child misbehaves or becomes violent in reaction to the parents' requests or orders, for example, the parents may give in to restore peace. Without meaning to, they may be teaching the child to be stubborn, and perhaps even violent (see photo).

Finally, a number of studies suggest that biological factors may play an important role in this disorder. Researchers have found, for example, that people with the disorder display lower serotonin activity than other individuals (Coccaro, Fanning, Phan, & Lee, 2016). Among other things, low serotonin activity has been linked to both impulsivity and aggression—key features of antisocial personality disorder (Duke et al., 2013). In addition, deficient functioning has been found in the frontal lobes of persons with this disorder (Reber & Tranel, 2019). Such a deficiency could help explain the poor planning, inferior judgments, and low empathy characteristic of this disorder (Glenn, Johnson, & Raine,

2013).

Still other research reveals that people with this disorder often experience less anxiety than other people, and so may lack a key ingredient for learning (Blair, Mitchell, & Blair, 2005). This would help explain why they have so much trouble learning from negative life experiences or tuning in to the emotional cues of others. Why should these individuals experience less anxiety than other people? It appears that many of them tend to respond to warnings or expectations of stress with low brain and bodily arousal (Davis-Siegel, Gottman, & Siegel, 2015). Perhaps because of the low arousal, the individuals easily tune out threatening or emotional situations, and so are unaffected by them. Recent brain scanning research is looking at the brains of Psychopaths and some of the differences found are described in Your Brain and Behavior 15.1.

15.1 Your Brain and Behaviour

Imagining the Psychopathic Brain

Psychopathy, which often fits under the category of antisocial personality disorder, and in the DSM-5 fits within the section on alternative model for personality disorders (Drislane et al., 2019), is a disorder that both fascinates and repels many of us. Psychopaths are often characterized by a distinct lack of feeling guilt, they often don't accept responsibility for their actions, and many view them as people who are willing to lie, manipulate, and charm to get what they want with very little or no empathy for the people they hurt. In a recent study comparing a group of psychopaths in the Netherlands to the U.S. one of the core features of psychopathy was a lack of empathy and a callousness toward others (Verschuere et al., 2017).

Approximately 1% of the population scores high on psychopathic traits. University of British Columbia professor emeritus Robert Hare has studied psychopathology for over 40 years. He is the creator of the Psychopathy Checklist and the Psychopathy Checklist Revised (PCL-R) that are used, in part, to predict the likelihood of psychopathic behaviour and to diagnose an individual with psychopathy (Hare, 2003; Ling & Raine, 2018). Dr. Hare's work formed the basis for our understanding of psychopathy from a behavioural perspective but what is happening in the brain's of these individuals? Dr. James Fallon at the University of California has spent his career imaging the brains of psychopaths and has found that the brain of a diagnosed psychopath is different from others in several key areas—especially the frontal lobes (Fallon, 2014)

While psychopathy is often associated with crime and deviance it is possible to be a diagnosed psychopath and live a very successful life without a history of illegal activity (Benning, Venebales & Hall, 2018). Interestingly, Dr. James Fallon is one of these individuals—he has the brain of a psychopath—similar to the very individuals he studies. This discovery was not intended, rather it happened by chance when his family was used as a control group for an Alzheimer's imaging study. One can only imagine Dr. Fallon's surprise at seeing his brain on a MRI scan looking indistinguishable from the brains of the psychopaths he studied. Individuals who score high in psychopathy but lead a successful life, such as Dr. Jim Fallon, are also now

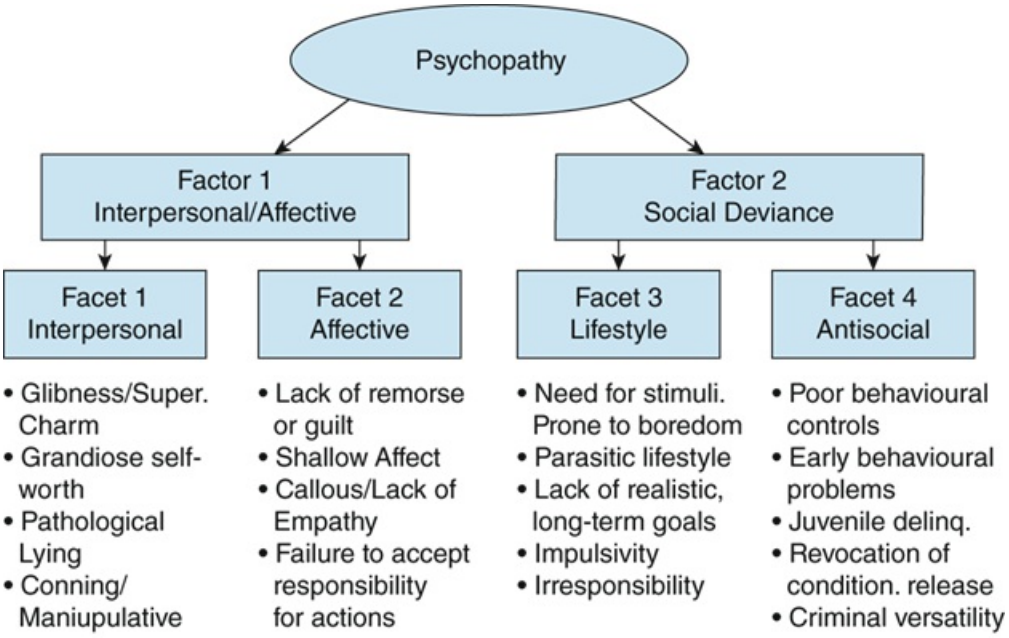
being studied and a recent brain imaging study has shown that there may be a higher density of grey matter—which indicates a higher density of neurons—in one area of the prefrontal cortex called the ventrolateral prefrontal cortex in these individuals. (Lasko et al., 2019)

Questions

What are the key behavioural characteristics of individuals who are diagnosed with psychopathy?

Which area of the brain has less activity during a cognitive task in individuals who score high on psychopathic traits?

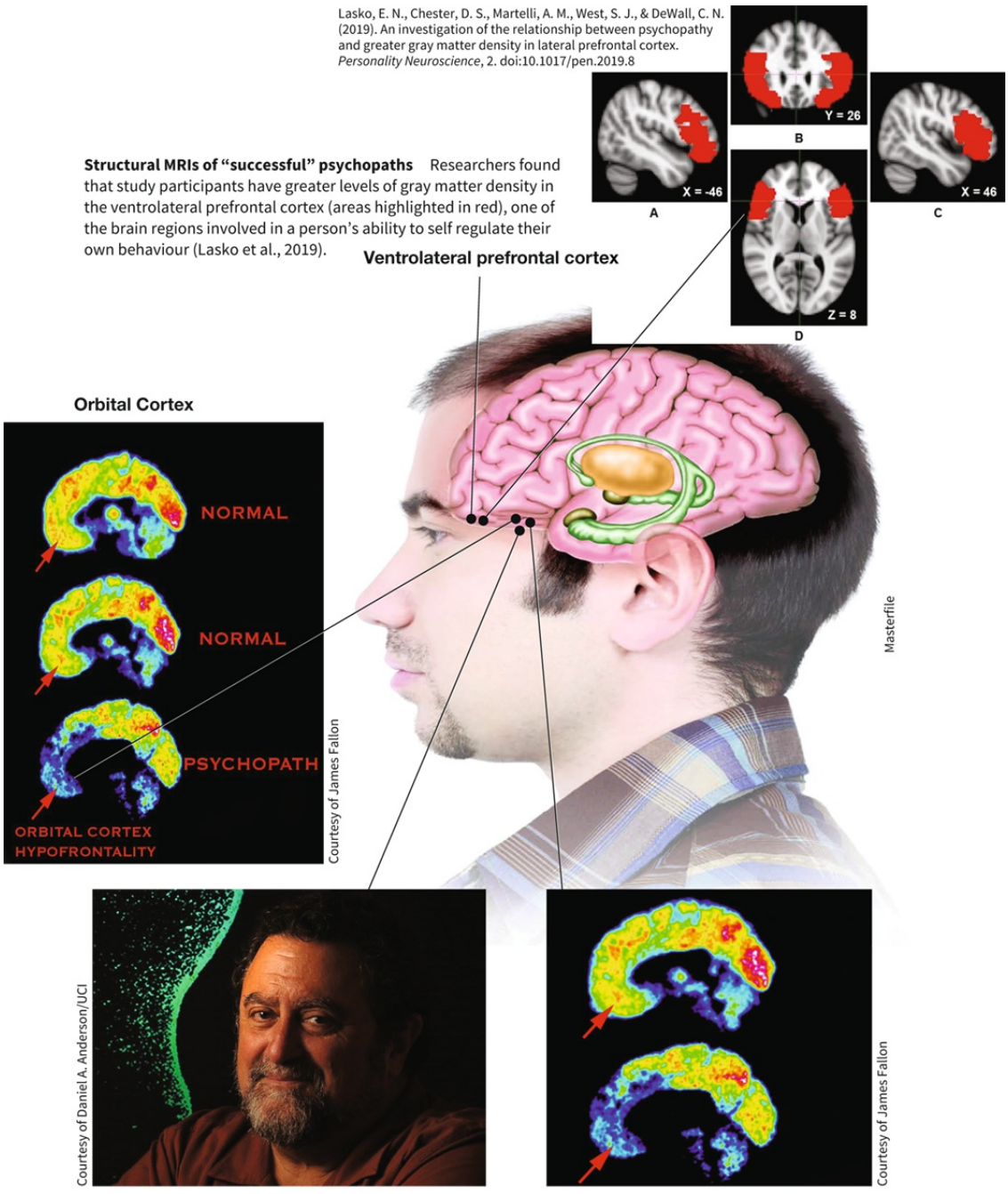
What areas of the brain have reduced connectivity between them when imagining another person in pain in individuals who score high on a checklist for psychopathy?



Scale structure of the PCL-R: Second edition Hare, R. D. Black, P.J., & Walsh, Z. (2003). The psychopathy checklist–Revised: Forensic Applications and Limitations. In R. P. Archer & E. M. A. Wheeler (Eds.) Forensic uses of Clinical Assessment Instruments. (pp. 230–265) New York, NY: Routledge.

The University of British Columbia

The psychopathology checklist by Dr. Robert Hare Dr. Hare at the University of British Columbia has been instrumental in describing psychopathic traits and has conducted forensic behavioural analysis of psychopaths. His work led to the development of the psychopathy checklist – revised (key elements shown here) which is still the primary questionnaire used by scientists to determine whether an individual has psychopathic tendencies (Hare, 2003).



Borderline Personality Disorder

People with **borderline personality disorder** display great instability, including major shifts in mood, an unstable self-image, and impulsivity. These characteristics combine to make their relationships very unstable as well (Paris, 2018: Gunderson, Weinberg, & Choi-Kain, 2013; APA, 2013). People diagnosed with this disorder move in and out of very

depressive, anxious, and irritable states that may last anywhere from a few hours to a few days or more. Their emotions seem to be always in conflict with the world around them. They are prone to bouts of extreme anger, which may at times result in physical aggression (Kolla, Meyer, Bagby, & Brijmohan, 2017; Martino et al., 2015; Leichsenring et al., 2011; Meyer, Ajchenbrenner, & Bowles, 2005; Koenigsberg et al., 2002).

> **borderline personality disorder** a personality disorder characterized by severe instability in emotions and self-concept and high levels of volatility.

Just as often, they direct their impulsive anger inward and inflict bodily harm on themselves—in the form of cutting or mutilating themselves (Goodman et al., 2017). Many try to hurt themselves as a way of dealing with their chronic feelings of emptiness, boredom, and identity confusion. Suicidal threats and actions are also common. Studies suggest that 75 percent of people with this disorder attempt suicide at least once in their lives; as many as 10 percent actually do commit suicide (Gunderson, 2011; Leichsenring et al., 2011).

People with borderline personality disorder frequently form intense, conflict-ridden relationships in which their feelings are not necessarily shared by the other person. They often violate the boundaries of a relationship. Thinking in *dichotomous* (black-and-white) terms, they quickly become furious when their expectations are not met. Yet they remain very attached to the relationships, paralyzed by a fear of being left alone. Sometimes they cut themselves or carry out other self-destructive acts to prevent partners from leaving (Berenson et al., 2011).

Around 2 percent of the general population is thought to suffer from this disorder (Paris, 2018; Volkert et al., 2018). Close to 75 percent of the patients who receive this diagnosis are women (Gunderson, 2011).

What Causes Borderline Personality Disorder?

Borderline personality disorder is not well understood. In recent years, however, a number of theorists have developed a *biosocial* theory to explain the disorder. According to this view, the disorder actually begins during childhood. It results from a combination of internal forces (for example, difficulty identifying and controlling one's arousal levels and emotions) and external forces (for example, an environment in which a child's emotions are punished or disregarded). If children have difficulties identifying and controlling their emotions, and if their parents further teach them to ignore their intense feelings, the children may never learn how to properly recognize and regulate their emotional arousal or how to tolerate emotional distress (Ahluwalia Cameron, Calderwood, & McMurphy, 2019; Chanen & Kaess, 2012; Arens et al., 2011).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

18. What distinguishes a pain disorder associated with psychological factors from a conversion or somatization disorder?

19. List and describe three dissociative disorders.

20. Which disorder discussed in this section is most closely linked to adult criminal behaviour?

What Do You Think? • Analyze a character from a film you have seen or a book you have read that has one of the disorders described in this section. Is the information provided in the text consistent with what you know of the character?

Summary

Defining, Classifying, and Diagnosing Psychological Abnormality

LEARNING OBJECTIVE 1 Identify the common features of most definitions of abnormal functioning, and describe how psychological disorders are classified and diagnosed.

The study of psychological disorders is usually called *abnormal psychology*. Abnormal psychological functioning is a wide-ranging problem in this country.

Definitions of psychological disorders often include the "four Ds"—deviance, distress, dysfunction, and danger.

The Diagnostic and Statistical Manual of Mental Disorders (DSM) (current version DSM-5) is the leading classification system in North America.

Models of Abnormality

LEARNING OBJECTIVE 2 Describe the major models used by psychologists to explain abnormal functioning.

Clinicians use several major models to explain abnormal functioning, including the neuroscience, psychodynamic, cognitive-behavioural, humanistic-existential, socio-cultural, and developmental psychopathology models.

The neuroscience model views abnormal functioning as a result of malfunctions in brain structure or chemical activity. Malfunctions can be caused by injuries or other factors, including genetics or viruses.

Psychodynamic theorists view abnormal functioning as the result of unconscious conflicts that may have originated in our early development. Freud focused on fixations during the oral, anal, and phallic stages of development, while other theorists have focused on difficulties in ego development or our relationships with others.

Behavioural theorists propose that abnormal behaviours develop via the same processes as more adaptive behaviours: classical conditioning, operant conditioning, and modelling. Cognitive theorists believe that abnormal functioning can result from disordered thoughts, including basic irrational assumptions, specific upsetting thoughts, and illogical thinking processes.

Humanists suggest that people are vulnerable to psychological disorders when they develop inaccurate views of their worth or goals in life. Existentialist therapies focus on helping clients discover their personal freedom of choice and take responsibility for making choices.

According to the socio-cultural model, abnormal behaviour is best understood in light of the social, cultural, and family forces brought to bear on an individual. Important factors include social change, socio-economic class membership, cultural background, social networks, and family systems.

Developmental psychopathology theorists are interested in how psychological disorders evolve, based on both genetics and early childhood experiences, and on how those early patterns affect people's functioning as they move through later life stages.

Mood Disorders

LEARNING OBJECTIVE 3 Describe and differentiate major depressive disorder and bipolar disorder.

The key features in mood disorders are *depression*—a low, sad state—and *mania*—a state of breathless euphoria. Most people with a mood disorder suffer only from depression.

People with *major depressive disorder* suffer a variety of symptoms, including feelings of sadness and lack of interest, low levels of activity and productivity, negative views of themselves and their lives, and physical ailments.

Today's leading explanations for major depressive disorder point to neuroscientific, psychological, or socio-cultural factors. Many theorists believe that the various explanations should be combined.

People with *bipolar disorder* experience not only the lows of depression, but also the highs of mania. In the manic state, they want constant excitement. They tend to show poor judgment and planning, hold inflated opinions of themselves, and show a great deal of energy.

Although genes and biological factors appear to play key roles in the development of bipolar disorder, there is growing evidence that stress and certain kinds of environmental events also must occur in order for episodes to unfold.

Anxiety Disorders

LEARNING OBJECTIVE 4 Describe the various types of anxiety disorders, and explain some causes of these disorders.

As a group, anxiety disorders are the most common mental disorders in North America. Often, people with one type of anxiety disorder have another type as well.

People with *generalized anxiety disorder* experience persistent feelings of worry and anxiety. Some cognitive theorists suggest that this disorder arises in people who hold certain dysfunctional or irrational assumptions, while others focus on the individual's intolerance of uncertainty. An important neuroscience explanation focuses on gamma-aminobutyric acid, a neurotransmitter involved in fear reactions.

People with *social anxiety disorder* display severe, persistent, and irrational fears of social or performance situations. Some socio-cultural factors appear to be involved.

People with *phobias* have a persistent and irrational fear of a specific object, activity, or situation. Behavioural principles, including classical conditioning and modelling, provide the leading explanations for specific phobias.

People with *panic disorder* have recurrent attacks of terror. These *panic attacks* are sometimes accompanied by *agoraphobia*—a fear of venturing into public places. A neuroscience-cognitive explanation of the disorder focuses on physical sensations produced by malfunctioning brain circuitry, which are then misinterpreted.

People with *obsessive-compulsive disorder* feel overrun by recurrent thoughts that cause anxiety (obsessions) and by the need to perform repetitive actions to reduce this anxiety (compulsions). While cognitive-behavioural theorists focus on the role of learning in these behaviours, neuroscientists focus on abnormally low levels of serotonin or abnormal functioning in specific brain regions.

People with *posttraumatic stress disorder (PTSD)* are tormented by fear and related symptoms well after a horrifying event has ended. Although extraordinary trauma causes the disorder, not everyone who experiences such trauma develops PTSD. Differences in biological processes, personalities, childhood experiences, social support systems, and cultural backgrounds make people more or less likely to respond to trauma by developing the disorder.

Schizophrenia

LEARNING OBJECTIVE 5 Describe the features of schizophrenia and some theories of what causes it.

Schizophrenia is a disorder in which people deteriorate into a world of unusual perceptions, odd thoughts, disturbed emotions, and motor abnormalities. These people experience *psychosis*, a loss of contact with reality.

Positive symptoms of schizophrenia are "pathological excesses" in behaviour. They include delusions, disorganized thinking and speech, hallucinations, and inappropriate affect.

Negative symptoms, or "pathological deficits," include poverty of speech, flat affect, loss of volition, and social withdrawal.

People with schizophrenia also sometimes experience unusual psychomotor symptoms, which in their most extreme form are collectively called *catatonia*.

Many theorists believe that people inherit a genetic predisposition to schizophrenia. Two kinds of brain abnormalities might be inherited—biochemical abnormalities and abnormal brain structure.

Although neuroscience explanations of schizophrenia have received by far the most research support, psychological and socio-cultural factors may help to bring about schizophrenia in people with a biological predisposition to develop it.

Other Disorders

LEARNING OBJECTIVE 6 Discuss the features and possible causes of somatic symptom and related disorders, dissociative, and personality disorders.

Somatic symptom and related disorders include five diagnoses: somatic symptom disorder, illness anxiety disorder, conversion disorder (functional neurological symptom disorder), psychological factors affecting other medical conditions, and factitious disorder.

Somatic symptom and related disorders are thought to result from classical conditioning, modelling, or misinterpretation of bodily cues, similar to anxiety disorders. Cognitive theorists suggest that people with one of these types of disorders are extremely sensitive to bodily cues and come to misinterpret them.

Changes in memory that lack a physical cause are called *dissociative disorders*. DSM-5 includes three major dissociative disorders: dissociative amnesia, depersonalization/derealization disorder, and dissociative identity disorder. In *dissociative amnesia*, people are unable to recall important information about their lives. In *depersonalization/derealization disorder*, stress alters perceptions, detaching the self from the body. In *dissociative fugue*, people not only forget their identities and their past lives, but also flee to a different location. In *dissociative identity disorder*, people develop two or more distinct personalities.

Psychodynamic theorists believe that dissociative disorders are caused by repression, the most basic ego defence mechanism, but this view has not received strong research support.

People with *antisocial personality disorder* persistently disregard and violate others' rights. Because of their potentially negative behaviour, such as lying, impulsiveness, and recklessness, they are frequently found in prison. According to behavioural theorists, this disorder can be learned through various means. Neuroscience explanations focus on brain factors, such as low serotonin levels, deficient frontal lobe functioning, and low arousal in response to warnings.

People with *borderline personality disorder* display great instability, including major shifts in mood, an unstable self-image, and impulsivity. This disorder is not well understood, but a recent biosocial theory proposes that it results from a combination of internal and external forces.

Key Terms

abnormal psychology

acute stress disorder

agoraphobia

antipsychotic drugs

antisocial personality disorder

automatic thoughts

bipolar disorder

borderline personality disorder
catatonia
cognitive triad
comorbidity
compulsions
delusions
depression
developmental psychopathology
diagnosis
Diagnostic and Statistical Manual of Mental Disorders (DSM)
dissociative disorder
equifinality
family systems theory
generalized anxiety disorder (GAD)
hallucinations
International Classification of Diseases (ICD)
loose associations or derailment
major depressive disorder
mania
multifinality
negative symptoms
obsessions
obsessive-compulsive disorder (OCD)
panic attacks
panic disorder
personality disorder
phobia
positive symptoms
posttraumatic stress disorder (PTSD)
psychosis
resilience
risk factors
schizophrenia

social anxiety disorder

somatic symptom and related disorders

Self-Study Questions

Multiple Choice

1. The medical model

a. encourages a search for patterns of symptoms.

b. is heavily dependent on social norms and values.

c. is unconcerned with underlying etiology.

d. disassociates physical illness and "madness."

2. Behaviour, thoughts, and emotions are considered abnormal when they differ from a society's ideas about proper functioning. Which of the following "four Ds" does this statement represent?

a. deviance

b. distress

c. dysfunction

d. danger

3. Which of the following statements best reflects the psychodynamic approach to defining abnormal behaviour?

a. It is learned through the observation of societal norms.

b. It is observed in other individuals we identify with.

c. It results from maladaptive thinking patterns.

d. It results from unconscious attempts to solve conflicts.

4. Humanistic and existential theories have in common a belief that

a. people are naturally inclined to live constructively.

b. people have complete freedom to give meaning to their lives or to run away from that responsibility.

c. people must have high levels of self-awareness to live meaningful, well-adjusted lives.

d. the therapist is an expert who can provide answers for the client.

5. Beck's cognitive triad includes negative thoughts about all of the following except

a. one's experience.

b. oneself.

c. others.

d. the future.

6. People with major depressive disorder often have low levels of the neurotransmitters

a. acetylcholine and dopamine.

b. dopamine and serotonin.

c. GABA and acetylcholine.

d. norepinephrine and serotonin.

7. Albert Ellis believed that abnormal patterns of functioning are caused primarily by

a. faulty conditioning.

b. imitating maladaptive models.

c. irrational assumptions.

d. learned helplessness.

8. The brain circuit that produces anxiety in a person includes all of the following brain structures except the

a. amygdala.

b. anterior cingulate.

c. hippocampus.

d. prefrontal cortex.

9. Which of the following is an example of a negative symptom of schizophrenia?

a. being unable to show any emotion

b. believing that others can read one's thoughts

c. hearing voices that are not real

d. using rapid, incoherent speech

10. A man who forgets the details of his life and identity and sets up a new life in a different location is likely experiencing dissociative

a. amnesia.

b. fugue.

c. identity disorder.

d. somatization.

Fill-in-the-Blank

1. A person whose thoughts or behaviour are far outside the norm for the time and place in which he or she lives is demonstrating the _____ aspect of psychological abnormality.

2. A client who is diagnosed with both major depressive disorder and generalized anxiety

disorder is said to be experiencing _____.

3. The notion of modelling, first studied by _____, helps explain why people whose parents had psychological disturbances often have psychological disturbances themselves.

4. The tendency for children who start out in the same situation to end up at very different places, psychologically speaking, is called _____.

5. Persistent Depressive Disorder (dysthymia) is to major depressive disorder as _____ disorder is to bipolar disorder.

6. The most common category of psychological disturbance in Canada is _____ disorders.

7. Posttraumatic stress disorder and _____ disorder have similar symptoms, but those symptoms arise at different points after the traumatic event and linger for different amounts of time.

8. In schizophrenia, _____ symptoms involve the addition of inappropriate behaviour, such as hallucinations or delusions.

9. The concordance rate for schizophrenia is much higher in _____ twins than in _____ twins, suggesting that genes play an important role in the development of the disorder.

10. Research shows that people with antisocial personality disorder often have deficient functioning in the _____ lobes of the brain.

CHAPTER 16
Treatment of Psychological Disorders

Steve Debenport/Getty Images

CHAPTER OUTLINE

Treatment in Today's World

LEARNING OBJECTIVE 1 Explain who receives treatment for psychological problems today, how they enter treatment, and what general features characterize different types of treatment.

Biological Treatments

LEARNING OBJECTIVE 2 Describe the major biological treatments for psychological disorders.

Psychodynamic Therapies

LEARNING OBJECTIVE 3 Describe the psychodynamic treatments for psychological disorders.

Behavioural Therapies

LEARNING OBJECTIVE 4 Describe the behavioural treatments for psychological disorders.

Cognitive-Behavioural Therapies

LEARNING OBJECTIVE 5 Describe cognitive-behavioural therapies for psychological disorders.

Humanistic and Existential Therapies

LEARNING OBJECTIVE 6 Describe the humanistic and existential therapies for psychological disorders.

Formats of Therapy

LEARNING OBJECTIVE 7 Describe commonly used formats of therapy.

Does Therapy Work?

LEARNING OBJECTIVE 8 Summarize research on the effectiveness of therapy.

Some Final Thoughts About the Field of Psychology

February: *She cannot leave the house; Romy knows that for a fact. Home is the only place where she feels safe—safe from humiliation, danger, and rejection. If she were to go to work, her co-workers would somehow reveal their contempt for her. A pointed remark, a quizzical look—that's all it would take for her to know how much they disliked her. If she were to go shopping at the store, before long everyone would be staring at her. Surely others would see her anxious mood and thoughts; she wouldn't be able to hide them. She didn't even dare to walk around her neighbourhood—her heart would probably start racing again, bringing her to her knees and leaving her breathless, incoherent, and unable to get home. No, she's much better off staying in her room, trying to get through another evening of her lonely existence. Thank goodness for social media. Were it not for her ability to connect through the Internet, Romy knew she would be completely alone.*

July: *Romy's busy social life revolves around a small group of friends: Anna, Charlotte, and Joseph from the office, where Romy was recently promoted to director of customer relations, and Kirby and Josh, her weekend hiking friends. Her friends meet for dinner every week at someone's house, and they chat about life, politics, and their jobs. Particularly special in Romy's life is Quinn. They go to movies, restaurants, and concerts together. Quinn thinks Romy is terrific, and Romy finds herself beaming whenever she thinks about Quinn or whenever Quinn is near. Romy looks forward to work each day and to her interactions with colleagues and customers. She's reconnected with family and old friends and is more fully enjoying her life than ever before.*

Romy's thoughts, feelings, and behaviour interfered with all aspects of her life in February, yet most of her symptoms had disappeared by July. Many factors may have contributed to Romy's improvement—advice from friends and family members, a new job or vacation, perhaps a big change in her diet or exercise regimen. Any or all of these things may have been useful, but they could not be considered **treatment**, or **therapy**. Those terms are usually reserved for specific, systematic procedures designed to change abnormal behaviour into more normal behaviour (see photo). According to clinical theorist Jerome Frank, all forms of therapy have three essential features:

A *sufferer* who seeks relief from the healer.

A trained, socially accepted *healer*, whose expertise is accepted by the sufferer and his social group.

A *series of contacts* between the healer and the sufferer, through which the healer tries to produce certain changes in the sufferer's emotional state, attitudes, and behaviour. The healing process may be brought about primarily by **psychotherapy**—in Frank's words, "by words, acts, and rituals in which sufferer, healer, and—if there is one—group participate jointly." Or it may be accomplished through **biological therapy**, consisting of "physical and chemical procedures" (Frank, 1973, pp. 2–3).

treatment or **therapy** systematic procedures designed to change abnormal behaviour into more normal behaviour.

psychotherapy a treatment system in which a client and therapist use words and acts to overcome the client's psychological difficulties.

biological therapy the use of physical and chemical procedures to help people overcome psychological difficulties.

BEW Authors/AGE Fotostock

Getting help **Therapy is a systematic procedure to help people deal with the pathology, adjustment issues, or day-to-day problems that are negatively affecting their lives.**

Healers are called *clinicians*, *clinical practitioners*, or *therapists*. You read about the work of *clinical researchers* in Chapter 15. As you saw, they systematically gather information so that they can better describe, explain, and predict psychological disorders. The knowledge that they acquire is then used by clinicians, whose role is to detect, assess, and treat people with psychological disorders. The important role Indigenous Elders can play as part of a clinical team is shown in Indigenous Experiences 16.1.

Despite Frank's (1973) straightforward definition, clinical treatment is surrounded by conflict and confusion. In fact, Carl Rogers has been cited as saying that "therapists are not in agreement as to their goals or aims. . . . They are not in agreement as to what constitutes a successful outcome of their work. They cannot agree as to what constitutes a failure. It seems as though the field is completely chaotic and divided" (Thorne & Sanders, 2013).

Some clinicians view abnormality as an illness and so consider therapy a procedure that helps cure the illness. Others see abnormality as a problem in living and therapists as teachers of more functional behaviour and thought. Clinicians even differ on what to call the person who receives therapy. Those who see abnormality as an illness speak of the "patient," while those who view it as a problem in living refer to the "client." Because both terms are common, this chapter will use them interchangeably.

16.1 Indigenous Experiences

Including Elders in Mental Health Care

Indigenous people in Canada experience significantly distorted rates of mental illness and suicidality, which are legacies of colonization, oppression, and systemic racism. Indigenous people frequently experience discrimination and indifference from health care providers, leading them to develop limited trust in the health care system for mental health and other issues (Browne et al., 2016). However, evidence suggests that Elders can play a transformative role in the mental health of Indigenous people in traditional settings (TRC, 2015).

One of the 94 calls to action of the Truth and Reconciliation Commission's report is to include Elders in the treatment of Indigenous patients in the wider health care system. Elders are "those who have shown wisdom and leadership in cultural, historical, and spiritual matters within their communities, and might not necessarily be old. Elders represent an essential connection with the past; they are keepers of the community knowledge and supporters of its collective spirit" (Hadjipavlou et al., 2018, p. E609).

George Hadjipavlou, at the University of British Columbia, and colleagues (2018) assessed the impact of a partnership program involving Indigenous Elders who provided direct patient care to Indigenous patients attending an inner-city primary care clinic. Patients had mental health and substance disorders as well as chronic pain or stigmatizing health conditions, such as HIV. Five overarching themes from participants representing 20 different First Nations were obtained:

> **Theme 1:** *Finding a place of healing after a prolonged period of seeking and desperation*: Participants found Elders to be non-judgmental, genuine, accepting, and safe. One said, "I feel that these people understand me, and they have a connection to … the trails I went down when I thought I was so alone, so ostracized and even abandoned." (p. E610)
>
> **Theme 2:** *Strengthening cultural identity and belonging*: Participants reported improvements in self-esteem and self-confidence because of Elders increasing the patients' sense of cultural identity. One said, "And meeting with [the Elders] has given me this: 'it's OK to be Native'…Like I know that, but they reinforced that … it's given me more confidence. It gave me a little bit more self-esteem. It's healed me a bit." (p. E611)
>
> **Theme 3**: *Developing trust and "opening up"*: In contrast to their mistrust of the health care system, participants reported trusting the Elders and "opening up" to engage meaningfully with their health and culture. One said, "[The Elder] really helped me through talking, just sitting and talking and just brought my spirit back." (p. E612)
>
> **Theme 4**: *Coping with losses*: Most participants had suffered multiple significant losses in their families and communities and reported that the Elders offered them ways to bear their grief. One said, "It cleared up a lot of things about growing up and life and losing my grandparents and losing my mom …and not just going nuts and committing suicide…I loved it, just talking with her." (p. E612)
>
> **Theme 5**: *Engaging in ceremony and spiritual dimensions of care as a resource for hope*: Participants reported that Elders provided spiritual guidance that they

could not access from traditional health care providers. These spiritual teachings helped them to restore hope. One said, "…this Elder program has changed – like changed my life. I'm willing to live now…I've never experienced anything as positive when it comes to my spiritual, emotional well-being. That having this kind of [Elder] support is life changing." (p. E613)

THE CANADIAN PRESS/Darryl Dyck

The role of Elders Elders are selected because they display highly valued qualities such as leadership, wisdom, and compassion, as well as demonstrate a deep understanding of their history, traditional teachings, and healing practices. Here, Elder Annie Johnson joins other Elders to lead a march in Vancouver, BC, to honour missing Indigenous women and girls.

The results of the Hadjipavlou et al. (2018) study demonstrate the need for including Elders in partnership with mainstream health care services for Indigenous people.

Critical Thinking Questions

Would you consider an Elder to be a clinician? Why or why not?

Based on the descriptions presented in the overarching themes, would you say that the Elders described, view abnormality as an illness or as a problem of living? Why?

Despite their differences, most clinicians do agree that large numbers of people need therapy of one kind or another. Later you will encounter empirical support indicating that therapy is indeed often beneficial to those who need it.

Treatment in Today's World

LEARNING OBJECTIVE 1

Explain who receives treatment for psychological problems today, how they enter treatment, and what general features characterize different types of treatment.

A Canadian Mental Health Association (CMHA, 2015) poll conducted by Nanos Research on mental health funding found that 94 percent of Canadians felt that as much or more government funding should be directed to mental health as physical health. The CMHA also cited a 2012 Statistics Canada survey that indicated that 1 in 6 Canadians over the age of 15 had a need for mental health services. The Mental Health Commission of Canada (2012) has also called for increased spending on mental issues. The number and variety of problems for which treatments are available have increased during the past century or more. When Freud and his colleagues first began conducting therapy during the late nineteenth and early twentieth centuries, most of their patients suffered from anxiety or depression. People with schizophrenia and other more severe disorders were considered poor prospects for therapy, and treatment for them was confined to custodial care in institutions (Levin, Hennessy, & Petrila, 2010).

Although a Statistics Canada report (2012) indicated that 76.9 percent of Canadians over 15 years of age perceived themselves to be "flourishing" with "complete" mental health, 10 percent of Canadians in that age group (2.8 million) reported symptoms associated with a mental disorder (major depressive episode, bipolar disorder, generalized anxiety disorder) or a substance use disorder in the past year (Statistics Canada, 2012). These disorders, including anxiety and depression, still dominate the therapy picture, as more than three-quarters of Canadians diagnosed with a mental illness each year suffer from one or the other of these two disorder types (Langlois et al., 2011). However, people with other kinds of disorders also receive therapy (NIDA, 2011; CDC, 2010; SAMHSA, 2010). People with schizophrenia and people with substance-related disorders, for example, make up a large percentage of the clients in therapy today. Moreover, large numbers of people with milder psychological problems, sometimes called "problems in living," are also in therapy. Surveys suggest that non-disordered reasons for entering therapy largely include problems with marriage, family, job, peer, school, or community relationships (Mojtabai et al., 2011).

Among other facts on its *Fast Facts about Mental Illness* page (www.cmha.ca/media/fast-facts-about-mental-illness), the Canadian Mental Health Association (2014b) states the following: 20 percent of Canadians will experience a mental illness in their lifetime; 8 percent will experience a major depression; 1 percent will experience bipolar disorder; and 5 percent of households will experience mild to severe anxiety. Importantly, the Canadian Mental Health Association also states that although mental illness can be treated effectively, many people do not seek treatment because of the stigma associated with mental illness.

Who Seeks Treatment?

Other characteristics of clients have also changed over the years. Until the middle of the twentieth century, therapy was primarily a privilege of the wealthy, largely because of the high fees that out-patients were required to pay. After all, Freud's fee for one session of therapy in 1925 was $25 (eqivalent to $371 in today's dollars). The current cost of private out-patient therapy varies by service and location. Provincial psychologists' regulatory groups (e.g., the Ontario College of Psychologists) set the hourly rate for psychological therapy. The hourly rate in Canada typically ranges from $125 to $225. However, with the

expansion of third-party coverage (such as Blue Cross) and the emergence of publicly supported community mental health centres, people at all socio-economic levels can now theoretically receive both out-patient and in-patient therapy at more affordable rates. However, in spite of moderate increases in support, timely, affordable psychological therapy continues to be out of reach for many individuals. There continue to be long wait times for access to publicly funded psychologists and high costs for quick access to private psychologists.

Women used to outnumber men in therapy by four to one, partly because they were less reluctant than men to seek help. Lately, however, our society's attitudes and sex-role expectations have been changing. Men are more willing to enter therapy than before (Oliffe et al., 2016; Strokoff, Halford, & Owen, 2016; Clement et al., 2015). In fact, more than one-third of today's therapy patients are male (NIDA, 2011; CDC, 2010). As you will see later in this chapter, however, members of ethnic minority groups tend to seek treatment for their psychological problems less often than members of the majority culture (Clement et al., 2015; Brown et al., 2014; Cheng, Kwan, & Sevig, 2013).

Entering and Receiving Treatment

People enter therapy in various ways. Many decide on their own to consult a therapist. Others may do so on the advice of a friend, family member, minister, physician, or other professional with whom they have discussed their difficulties. Still others are forced into treatment. Parents, spouses, teachers, and employers may virtually order people to seek treatment if they are causing disruptions or are in obvious distress; or judges may formally pronounce people mentally disturbed and dangerous and commit them to a mental hospital for treatment.

fizkes/Shutterstock.com

The stigma of seeking therapy **Many people don't seek therapy because there is a social stigma associated with it. Instead, they suffer in silence. The truth is that therapy can benefit anyone, and it is not a weakness to seek help.**

In most cases, the decision to seek therapy is not easy. Stigma is a barrier to seeking treatment for many (Clement et al., 2015). Extensive studies indicate that most individuals are aware of their problems well before they look for help (see photo). Many wait more

than two years after they first become aware that they have a problem. And it is estimated that at least half of the people with psychological disorders never seek treatment (Ndumele & Trivedi, 2011).

The under-use of therapy has a long history. Back in the 1970s, for example, a labour union in the United States, the United Auto Workers, negotiated a contract in which management agreed to pay the entire cost of both in-patient and out-patient mental health services for a million union members. Yet, after three years, only 1 percent of eligible workers had used the benefit (Brown, 1976). Apparently they and their referral agents (shop foremen, clergy, and others) were either unaware of the benefit, ignorant of what therapy could do for them, unlikely to think about personal problems in mental health terms, or worried about the stigma that psychological problems might bring in their social set.

Heather Stuart of Queens University, the first Bell Mental Health and Anti-Stigma Research Chair (from 2013–2014), and currently the senior consultant to the Mental Health Commission of Canada's Opening Minds program, has reviewed the history of efforts within Canada to reduce the stigma associated with acknowledging and obtaining treatment for mental illness (Stuart et al., 2014). As far back as the 1950s, efforts were underway to reduce the stigma associated with mental illness and to help Canadians move toward an understanding that many mental illnesses can be treated, and that most can be treated outside of hospital settings. For example, as efforts were underway to reduce the number of mental patients treated in hospitals, there was initial resistance from the public based on unfounded fears regarding public safety if mentally ill people were treated on an out-patient basis. Since that time, there has been a significant reduction in the stigma associated with mental illness (Stuart, 2012). However, perceptions of stigma continue to play a role in people's decisions about whether or not to acknowledge their mental issues and whether or not to seek treatment.

Conducting Treatment: Who, Where, and How

A variety of professionals conduct therapy today. Most are psychologists, psychiatrists, counsellors, and psychiatric social workers. Whatever their profession, these therapists generally see the same kinds of clients. That is, the majority of their clients are people with anxiety, depression, or relationship problems. However, although psychiatrists treat clients with depression, anxiety, and relationship issues, they see a much larger number of patients with schizophrenia, bipolar disorders, and other severe disorders than do psychologists, counsellors, or social workers. The providers of mental health services are concentrated in urban areas across Canada. As a result, there is a shortage of practitioners available to serve the needs of the many people who live in rural areas (Beaulieu & Schmelefske, 2016; Dyck & Hardy, 2013; Sealy, 2012). Even in the larger centres, some kinds of services are easier to access (e.g., medications through hospital psychiatric or emergency wards) than others (e.g., counselling, therapy, and support).

Therapy takes place in a wide variety of settings, from public institutions to schools to private offices. Most clients, even those who are severely disturbed, are treated as out-patients. They live in the community and make regular visits to the therapist's office or hospital/clinic. Most of the people who receive in-patient treatment, whether in the psychiatric wards of general hospitals or in psychiatric hospitals, have severe psychological problems (Craig & Power, 2010). As already discussed, the Canadian health care system

promises to ensure mental health services and necessary treatments to all who need them, either through hospital facilities or out-patient clinics. However, inadequate funding means that many individuals with mental health needs go untreated (Johansen & Sanmartin, 2011).

Republic Pictures/Stringer/Archive Photos/Getty Images

The "crazy house" For many, the perception of psychiatric care continues to be something like the treatment received by the patients portrayed in the well-known movie *One Flew Over the Cuckoo's Nest* (Beachum, 2010). However, the reality is that laws and policies protect Canadians hospitalized with mental illness.

Guidelines for admitting individuals to psychiatric facilities, either voluntarily or involuntarily, are provided in the Canadian Mental Health Act. This act includes information on the conditions under which people can be admitted and detained in hospital against their will, and also outlines the rights of patients in psychiatric facilities (see photo; Lewis, 2013).

Clinicians have become increasingly concerned about the negative effects of long-term institutionalization. Thus, beginning in the 1960s, clinicians lobbied for a policy of *deinstitutionalization* (Davison et al., 2010). In 2006, Patricia Sealy and her colleague, Paul Whitehead at the University of Western Ontario, examined the impact of 40 years of deinstituionalization, reporting that the policy had variable impacts on mental health provinicially. Their results suggested that the earlier that provinces implemented deinstituionalization, the lower the levels of social inequities for access. (Sealy, 2012). The number of psychiatric beds per 1,000 people went from four in 1964 to one in 1975, and the total number of psychiatric beds dropped from 54,801 in 1975 to 20,301 in 1981 (see also Goldner, Bilsker, & Jenkins, 2016; Sealy, 2012).

Hospitalization today usually lasts weeks instead of months or years. When people develop severe psychological disorders, therapists now try to treat them first as out-patients, usually with medications along with other forms of therapy. If this strategy proves ineffective, the patient may be admitted to a hospital for a short period (usually 24 to 72 hours) so that the condition can be monitored, diagnosed, and stabilized. As soon as

hospitalization has served the purpose of stabilization, the patient is returned to the community.

In theory, this may seem a reasonable treatment plan for people with severe psychological disorders. However, as you will see later, community treatment facilities have been so underfunded and understaffed over the years that they have not been able to meet the treatment needs of the majority of severely impaired people. Indeed, many people with severe psychological disorders are currently condemned to an endless cycle of hospital discharges and readmissions, and are often homeless (Adair et al., 2016; Sealy, 2012). According to the Canadian Institute for Health Information (2012), 14.7 percent of all hospitalizations in Canada involve a mental health diagnosis, with one-third of these patients being readmitted to hospital within one year of release following treatment of a mental illness. Moreover, Sealy & Whitehead's 2006 data indicated that most people with the highest levels of distress continued to be unable to access mental health services at all (Sealy, 2012).

Whether treated as an out-patient or in hospital, not all patients have similar experiences. By some estimates, there are more than 400 forms of therapy in the clinical field today, each practised by clinicians who believe that their chosen methodology is highly effective (Consoli, Beutler, & Bongar, 2017). Typically, therapists use principles and techniques that they have been trained in and that are consistent with the theories of psychological dysfunction they have been taught (Karpiak, Norcross, & Wedding, 2016).

In Chapter 15, you read about today's leading theories for explaining psychological disorders. Proponents of those explanations have proposed corresponding treatment approaches, and clinical practitioners have put those approaches into action as they work with clients. Carl Rogers's humanistic theory, for example, identifies self-awareness and self-actualization as fundamental to good mental health. Correspondingly, therapists who follow his client-centred treatment approach listen to and empathize with clients, expecting that such techniques will help the clients become better aware of themselves and more able to actualize their special human potential (Nienhuis, et al., 2016).

The following sections in the chapter focus on biological, psychodynamic, behavioural, cognitive-behavioural, and humanistic-existential therapies (see **Table 16.1**). Recall from our chapter opener, though, that all these forms of therapy have three essential features: a sufferer who seeks relief, a trained healer, and a series of contacts between the two in which the healer tries to bring about changes in the sufferer's emotional state, attitudes, and behaviour.

TABLE 16.1

Comparison of Treatments for Psychological Disorders

	Goals of Therapy	Therapy Techniques	Strengths	Weaknesses
Biological Approaches	Improve structural or biochemical	Psychotropic drugs; electroconvulsive	Often effective for people	Side effects Not always effective

	functioning; relieve symptoms	therapy (ECT); psychosurgery	whose problems don't respond to other treatments	May neglect non-biological problems of clients
Psychodynamic Approaches	Discover source of conflicts and resolve them	Free association; therapist analysis of resistance, transference, and dreams; catharsis; and working through problems	Offered first major alternative to biological treatments Sees abnormal functioning as rooted in same processes as normal functioning Model for many other psychological treatments	Depends on therapist's subjective interpretation
Behavioural Approaches	Learn more functional behaviours	Desensitization; aversion therapy; operant conditioning, including token economies; therapist modelling, including social-skills training	Research often supports effectiveness of treatments	Effects of treatment may not always last long after treatment stops May neglect unobservable cognitive processes
Cognitive-Behavioural Approaches	Change harmful thinking patterns to more useful ones	Rational-emotive therapy; cognitive therapy; cognitive-behavioural techniques	Considerable research support for its application to several disorders	Dysfunctional thinking may result from, not cause, abnormal functioning

Humanistic and Existential Approaches	Provide support for honest self-appraisal, self-acceptance, and self-actualization	Client-centred and Gestalt therapy techniques; existential therapy	Recognize positive human goals Recognize distinctly human values and needs	Unsupportive and limited research to test effectiveness

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

1. What trends have changed who tends to receive treatment for psychological disorders?

2. How does in-patient therapy differ from out-patient therapy?

3. What are the three key features common to all forms of therapy?

What Do You Think? • Why do you suppose people tend to wait so long before seeking help for a psychological problem? If you were experiencing some sort of psychological difficulty—say, depression—how do you think you would arrive at the decision to get treatment?

Biological Treatments

LEARNING OBJECTIVE 2

Describe the major biological treatments for psychological disorders.

Biological therapies use chemical and physical methods to help people overcome their psychological problems. The practitioners who apply such approaches are usually *psychiatrists*, therapists whose training includes medical school. The three principal kinds of brain biological interventions are *drug therapy*, *electroconvulsive therapy*, and *psychosurgery*. Drug therapy is by far the most common of the biological approaches.

Drug Therapy

Many types of disorders are treated with drug therapies or medical or surgical procedures that act directly on the central nervous system. We will first address the use of **psychotropic drugs**; drugs that act primarily on the brain and, in many cases, significantly reduce the symptoms of psychological disorders (Julien, Advokat, & Comaty, 2011) (see

photo). We will then discuss other medical interventions for treating psychological disorders.

psychotropic drugs medications that act primarily on the brain.

Since the 1950s, discoveries in *psychopharmacology* (a branch of study that focuses on the action of drugs on the mind and behaviour) have transformed the treatment of psychological disorders. Such drugs are now widely used, either as the first-line treatment for a disorder or in conjunction with psychotherapy or other interventions (Hammersley, 2016).

As you can see in **Table 16.2**, four major psychotropic drug groups are used in therapy: antipsychotic drugs, antidepressant drugs, mood stabilizers, and antianxiety drugs. **Antipsychotic drugs** help reduce the confusion, hallucinations, and delusions of *psychotic disorders*, the disorders (such as schizophrenia) marked by a loss of contact with reality, as well as the severe mood disorders accompanied by delusions. **Antidepressant drugs** help improve the mood of people who are depressed. **Mood stabilizing drugs** help level the moods of those with a bipolar disorder, the condition marked by mood swings from mania to depression. **Antianxiety drugs**, also called *minor tranquilizers* or *anxiolytics*, help reduce tension and anxiety. Let's look at each of these drug groups in turn.

antipsychotic drugs psychotropic drugs that help correct grossly confused or distorted thinking.

antidepressant drugs psychotropic drugs that lift the mood of depressed people.

mood stabilizing drugs psychotropic drugs that help stabilize the moods of people suffering from bipolar disorder.

antianxiety drugs psychotropic drugs that reduce tension and anxiety.

Stephen Kelly - PA Images/Getty Images

Psychopharmacology Drugs are now widely used to treat psychological disorders, often in conjunction with other forms of therapy.

Antipsychotic Drugs

Beginning in about 1955, individuals suffering from schizophrenia and other disorders were frequently prescribed antipsychotic drugs. The use of these drugs and the reduction of symptoms had the effect of radically reducing the number of mentally ill involuntarily hospitalized and institutionalized patients in the decades that followed. As discussed above, Paul Whitehead, from the University of Western Ontario, and his colleague Patricia Sealy argued that deinstitutionalization was not implemented consistently across geographic areas, with different provinces showing variation in their timing and approaches (as cited by Davies et al., 2016). In the years following the accidental discovery of the antipsychotic drugs, there was rapid closure of beds in psychiatric hospitals across Canada. However, there was a concomitant increase in beds in general hospitals for use by psychiatric patients. As well, because psychiatric in-patients were discharged into the community at a time when growth in community mental health services was slow across Canada, the unintended effect of releasing people incapable of caring for themselves without support, in many cases, resulted in homelessness (see photo).

TABLE 16.2

Commonly Prescribed Psychotropic Drugs
Source: Reprinted with permission of John Wiley & Sons, Inc., from Kowalski, R., & Westen, D. (2011). Psychology (6th ed.). Hoboken, NJ: Wiley, p. 598

Symptom	Type of Medication	Examples
Psychosis	Antipsychotics	chlorpromazine (Thorazine) clozapine (Clozaril)
Depression	Tricyclic antidepressants MAO inhibitors	trazodone (Desyrel) amitriptyline (Elavil) desipramine (Norpramin) phenelzine (Nardil)
Mania	Mood stabilizers	lithium (Lithonate)
Anxiety	Anxiolitics Antidepressants	benzodiazepines (Valium, Xanax) fluoxetine (Prozac)

Skyak/Getty Images

Mental illness and homelessness **Individuals suffering from severe mental illness are disproportionally and more seriously affected by homelessness than those without mental illness.**

The classic antipsychotic drugs include chlorpromazine (trade name: Thorazine), thioridazine (Mellaril), and haloperidol (Haldol). These drugs help patients experiencing positive symptoms such as hallucinations and paranoia. However, patients experiencing negative symptoms often get little relief from the classic antipsychotic drugs. New generation drugs, the atypical antipsychotics, such as clozapine (Clozaril), resperidone (Risperdal), and olanzapine (Zyprexa), help patients who do not respond to the typical antipsychotics, as well as some with negative symptoms such as apathy, diminished affect, and poverty of speech (Marder, 2014). These drugs have also proven to be particularly effective for schizophrenics who have persistent suicidal thoughts or who engage in self-injurious behaviours (Pompili et al., 2016). Studies indicate that antipsychotic drugs reduce psychotic symptoms within one and eight weeks, to lesser or greater degrees from one individual to another, about 70 percent of the time (Zhang, 2016).

It is thought that antipsychotic drugs work by blocking dopamine receptors, thereby blocking dopamine activity at the receptor sites (Ogino et al., 2014), although the exact nature of the relationship between the neurochemical effect and clinical outcomes is as yet unclear (Weinstein et al., 2017; Winton-Brown, Fusar-Poli, Ungless, & Howes, 2014). It is important to note, however, that the dopamine hypothesis does not necessarily argue for more dopamine, but rather for more activity at the receptor sites. Moreover, atypical antipsychotics affect both dopamine and serotonin activity (Meltzer, 2013), and more recent research has identified decreased glutamate activity as playing an important role (Laruelle, 2014). Therefore, a number of neurotransmitter systems have been implicated. A number of researchers have argued that the drug companies have pushed the dopamine hypothesis because they have made billions of dollars on the drugs they sell; these authors contend that this has prevented other, perhaps more productive, solutions from being pursued (Mosher, Gosden, & Beder, 2013).

Atypical antipsychotics tend to be the front-line treatment for schizophrenia (Meltzer, 2013; Miyake, Miyamoto, & Jarskog, 2012). There is controversy about whether the second-generation drugs are superior to the classic antipsychotic drugs, with some researchers suggesting the atypical antipsychotics are superior to the classic antipsychotic drugs, and other researchers suggesting no difference in effectiveness between the classic and second-generation drugs (Julien et al., 2013; Meltzer, 2013). This debate aside, determining a single course of treatment for a given patient is very difficult. Given the multiple and complex symptoms associated with schizophrenia, the wide individual variation in the response to drugs (in terms of both efficacy and side effects), as well as the diversity of treatment options, this disorder is very difficult to treat (Yin et al., 2017; Massey, Li, & Meltzer, 2014). Long-term outcome is highly correlated with early diagnosis, and treating negative symptoms continues to be an obstacle (Gaebel et al., 2014) as does conceptualizing and understanding treatment-resistant schizophrenia (Gillespie et al., 2017).

Antipsychotic drugs may also cause serious side effects (Flanagan & Ronaldson, 2016). The classic antipsychotic drugs can produce severe movement abnormalities, including severe shaking, contractions of the face and body, and extreme restlessness (Geddes, Stroup, & Lieberman, 2011); can cause Parkinson-like symptoms such as tremors, posture imbalance, and muscle rigidity (recall that Parkinson's is caused by too little dopamine); and in serious cases can cause a disorder called tardive dyskinesia. *Tardive dyskinesia* is a neurological disorder marked by involuntary repetitive tic-like symptoms affecting the tongue, lips, and face, as well as the trunk and extremities. Symptoms often persist well after the medication that caused the disorder has been terminated (Chandra, Seth, Mehta, & Dave, 2017). The atypical antipsychotics do not inevitably come with the risk of movement abnormalities, although they can also have unwanted movement side effects (Chandra et al., 2017), as well as other side effects. For example, in a small percentage of cases—about 1 percent—clozapine lowers the white count in the blood cells to dangerously low numbers and the patient becomes highly susceptible to infection. As a result, those who take the drug have to take regular blood tests to monitor for this toxic reaction (Girardin et al., 2014). As well, the atypical antipsychotics in general are associated with obesity and diabetes (Wei Xin Chong et al., 2016). Side effects have serious consequences; due to the unpleasant side effects associated with these drugs, many patients discontinue their medications and relapse within a year (Kishimoto, 2013).

Antidepressants

Americans are among the biggest consumers of antidepressants in the world (used by 11 percent of the population) with Canadians not far behind (9 percent of the population) (Kantor et al., 2015; OECD, 2013). Antidepressants are primarily used for treating mood disorders, particularly depression, but some antidepressants (SSRIs, as explained below) are also useful for treating anxiety, particularly generalized anxiety disorder, OCD, and panic disorder (Gordon, Brandish, & Baldwin, 2016). Antidepressants primarily target the serotonin and norepinephrine pathways (Fakhoury, 2016). Those with more severe depression tend to respond best to antidepressants, whereas those with mild to moderate depression receive little to some benefit (Cameron, Reid, & MacGillivray, 2014).

Marco Rosario Venturini Autieri/Getty Images

Antidepressant drugs **The antidepressant fluoxetine (Prozac) works by blocking the reabsorption of the neurotransmitter serotonin from the synapse. By keeping serotonin in the synapse longer, the serotonin has a stronger effect.**

Prior to 1987, two classes of antidepressants were commonly prescribed: tricyclics (Elavil) and MAO inhibitors (Nardil). Tricyclics work by blocking the reuptake of serotonin and norepinephrine. The result is elevation of synaptic concentrations of these neurotransmitters in the synapse and increasing activity at both receptor sites (Nelson, 2013). Monoamine oxidase inhibitors (MAOIs) prevent the monoamine oxidase enzymes from breaking down norepinephrine, serotonin, and dopamine, thereby increasing their availability (Wimbiscus et al., 2010). Traditionally, MAOs were a last line of defence because of dietary restrictions associated with their use to prevent the spiking of blood pressure. There is now some question of whether this restriction is as necessary as once believed (Grady & Stahl, 2012).

Fluoxetine (Prozac), sertraline (Zoloft), and paroxetine (Paxil) work by blocking the reabsorption of serotonin from the synapse (see photo). For this reason, this group of drugs is called selective serotonin reuptake inhibitors (SSRIs). These drugs exert their effect by keeping serotonin in the synapse for longer, enabling it to exert a stronger effect (see Your Brain and Behaviour 16.1). SSRIs are relatively fast acting, with approximately 60 percent of patients noting improvement after two weeks (Duman et al., 2016; Wilson, Chen, & Darji, 2016).

SNRIs or serotonin reuptake inhibitors, including drugs such as venlafaxine (Effexor) and duloxetine (Celexa), act by blocking the reabsorption of serotonin and norepinephrine from the synapse. There is some evidence that this class of drugs is somewhat more effective at treating symptoms of depression than the SSRIs (Blier, 2016). However, SNRIs have more side effects than the SSRIs, including increased risk for diabetes and cardiovascular problems (Bezchlibnyk-Butler, Jeffries, Procyshyn, & Virani, 2013).

Research shows that SSRIs are equally as effective as tricyclics, but without the side effects, and their use is associated with better rates of compliance (Von Wolff et al., 2013). Since the side effects of tricyclics can include erectile dysfunction, reduced sex drive, heart arrhythmias, tremors, and confusion, SSRIs are highly desirable as a first line of treatment. In fact, the Canadian Network for Mood and Anxiety Treatments (CANMAT) partnered with

the Canadian Psychiatric Association in 2001 to produce clinical guidelines for the treatment of depression. This body has approved the use of second-generation antidepressants (SSRIs and SNRIs) over first-generation antidepressants (tricyclics and MAOIs) as a first-line approach (Lam et al., 2016).

Ketamine, a nonbarbituate drug previously used as an anesthetic for humans or for veterinary use, and with a history of abuse as a club drug, is being touted by some as the drug of choice for high-risk patients suffering from treatment-resistant mood disorders such as bipolar or major depressive disorder. At low doses, ketamine exerts an antidepressant effect that takes effect in minutes to hours (rather than weeks to months) and therefore some researchers argue that ketamine (brand name Ketalar) is a rapid, potent, effective drug option for one-time use in these patients as well as for suicidal patients (Tuck & Ghazali, 2017; Abdallah, Sanacora, Duman, & Krystal, 2015). However, this claim is controversial because other researchers (Tracy, Caddy, & Shergill, 2016) argue that the drug is classified in Canada by the Controlled Drug and Substances Act as a Schedule 1 narcotic. (Schedule I drugs are substances that must be prescribed following a diagnosis and must be used in a controlled or regulated setting.) Tracy et al. argue that ketamine has recognized dangerous side effects associated with neurotoxicity and abuse/addiction and has limited data on ongoing usage in humans. Others feel that the drug has potential in long-term depression treatment as a bridging drug and can be used until longer-acting SSRIs or SNRIs take effect (Wilson, Rosenberg, & Ning, 2016).

Also of concern in the last 10 years or so has been the finding that antidepressants, particularly SSRIs, increase the risk for suicide especially among children, adolescents, and emerging adults (Hetrick et al., 2017). More recent evidence suggests that this risk is heightened within the first month or two of the patient beginning the course of treatment (Gibbons et al., 2015). Other studies have failed to replicate this claim for increased risk and instead argue that, after controlling for severity of depression, the risk for suicide actually goes down (Garland, Kutcher, Virani, & Elbe, 2016; Leon et al., 2011). Nevertheless, patients with serious depression need to be closely monitored when they begin treatment (Gibbons et al., 2015). Regulatory warnings from the U.S. Food and Drug Administration, as well as from Health Canada, have resulted in a black box warning for all antidepressant use in those under 18 years of age. Blackbox warnings are the strictest labeling requirment used by the FDA to highlight serious or life-threatening side effects from drugs. Many are questioning the wisdom of this caution, arguing that there is no evidence for increased risk in this age group, and that untreated individuals are at greater risk than those being treated with antidepressants (Dubicka Cole-King, Reynolds, & Ramchandani, 2016; Sparks & Duncan, 2013).

Mood Stabilizers

Mood stabilizers are used to treat intense shifts in mood from one extreme state to another, preventing both depression and mania in those with bipolar disorder. Lithium, a salt, is the most commonly prescribed drug used to maintain a stable mood and to prevent future relapse or reoccurrence of depression or mania (Bauer & Gitlin, 2016; Chengappa & Gershon, 2013). Although lithium can be used to treat acute manic or depressive symptoms, antidepressants and antipsychotics are more commonly used (Schuepbach, 2015). Lithium has a number of serious side effects, including thyroid and kidney disease,

renal failure, loss of memory, cardiac arrhythmia, loss of bladder and bowel control, and more (Gitlin, 2016). As a consequence, alternatives to lithium have been identified. The most common alternative to lithium is valproate, an anticonvulsant agent. The direct mechanisms by which valproate stabilizes mood is unknown but probably involve a class of enzymes known as histone deacetylases (Chiu, Wang, Hunsberger, & Chuang, 2013; Schloesser, Martinowich, & Manji, 2012). Patients taking valproate are more likely to continue taking their medications than those taking lithium (Cipriani et al., 2013). Some patients are treated with a combination of lithium and valproate, or lithium in combination with other drugs (Chiu et al., 2013; Post et al., 2010). In addition to other concerns, but also because of the number of unpleasant side effects associated with these drugs, patients are frequently unwilling to adhere to their medical protocols; men are more likely than women to be non-compliant (Murru et al., 2011).

Antianxiety Drugs

The most popular antianxiety drugs are in the benzodiazepine family. Common drugs are diazepam (Valium), alprazolam (Xanax), and lorazepam (Ativan) (see photo). These drugs are often referred to collectively as tranquilizers. Unlike the drugs already discussed, which can take weeks to exert a full effect, antianxiety drugs immediately relieve the symptoms of anxiety (Bandelow et al., 2015). However, they are also fast-acting, and so their effects wear off within hours.

Tommaso Altamura/123 RF

Antianxiety drugs **Antianxiety drugs, such as diazepam (Valium), provide immediate relief of anxiety symptoms; however, their effects wear off quickly, often within hours.**

One problem with the benzodiazepine family of drugs is that they can be abused. When a patient takes an antianxiety drug, there is an almost immediate alleviation of anxiety; patients may therefore find themselves reaching for the medication with greater and greater frequency in an effort to seek immediate relief from their unpleasant symptoms, creating psychological dependence (Starcevic, 2014). As well, because the medication only alleviates the symptoms, the underlying causes for the anxiety are never addressed. These drugs also cause physiological dependence, and sudden cessation following heavy use is associated with withdrawal symptoms, including insomnia and increased anxiety (Lader &

Kyriacou, 2016).

Drug Therapy Summary

Many of the medications we have discussed have radically changed the lives of many people with psychological disorders. Drugs are increasingly being prescribed for every type of mental illness. Studies have indicated that psychiatrists prescribe on average two to three prescriptions per patient (Mojtabai & Olfson, 2010). One Canadian study showed that general practitioners in Quebec provided drug therapy to the majority of patients suffering from symptoms of depression and also prescribed antidepressants to treat unrelated symptoms such as insomnia and pain (Wong et al., 2016). However, it is important to note that these drugs do not work for everyone and often come with potential side effects that range from annoying to life threatening. It is therefore important to assess whether a particular drug is effective.

In order to assess the efficacy of a particular drug, researchers must take into account how many people who are untreated get better. That is, if we do nothing, how many people will spontaneously recover? It is also important to assess whether patients are responding to a particular drug or to the *idea* of the drug. That is, it is important to assess whether patients get better because they *expect* to get better, or they get better because the medication exerts an effect. For this reason, psychologists and physicians use the technique of the *double-blind procedure* (see **Figure 16.1**). In this method, some of the participants take the drug being tested and some take a placebo. (A **placebo** is an inactive substance that exerts no pharmacological effect.) Neither the patient nor the physician (or others dealing directly with the patient) know which drug the patient is taking.

> **placebo** an inactive substance, such as a sugar pill or distilled water, that mimics a drug but has no active ingredients.

Regardless of how effective a drug is, research shows that in most instances a combination of psychotherapy and drugs has a stronger effect than drugs alone (Oestergaard & Møldrup, 2011). And, as discussed throughout this book, it is also important to recall that many psychological disorders arise from the social conditions under which people live. It is therefore important that as a society we seek to redress the inequities and discrimination that underlie many of the mental illnesses people experience (Nazroo, Bhui, & Rhodes, 2020; Shim, Kho, & Murray-García, 2018).

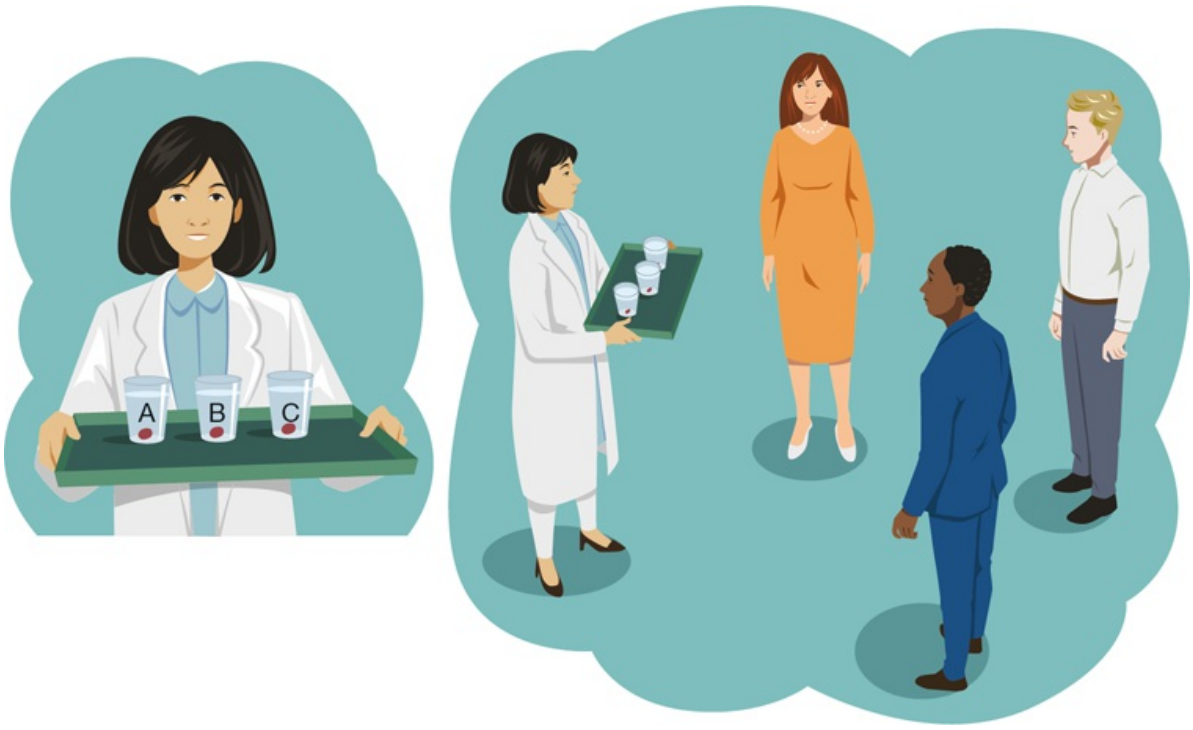


FIGURE 16.1 A double-blind study In order to reduce bias, in a double-blind study neither the patient nor the experimenter know which drug a patient is taking.

16.1 Your Brain and Behaviour

Taking an Antidepressant

When people have symptoms of depression so severe that they interfere with normal functioning, physicians will sometimes prescribe the use of antidepressant medication. Some of the most commonly prescribed antidepressants are selective serotonin reuptake inhibitors (SSRIs); these drugs are known by trade names such as Celexa, Paxil, Prozac, and Zoloft. The primary action of these drugs is to increase the availability of the neurotransmitter serotonin in the brain. Neurons that make serotonin are present in the brainstem raphe nuclei. These neurons send axon projections to the cortex, hippocampus, and amygdala, among other regions. SSRIs have a multitude of effects on these brain regions, although the precise mechanisms by which the drugs alleviate symptoms of depression are not known. How might antidepressant drugs work?

Questions

Which area of the cerebral cortex often shows reduced activity in people who are depressed?

What does it mean to say that a particular drug is a "serotonin reuptake inhibitor"?

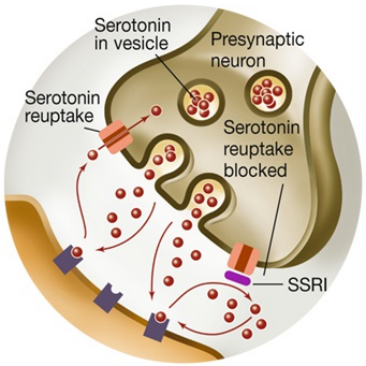
What is the role of the hippocampus in the recovery of someone taking

antidepressent medication to relieve depression?

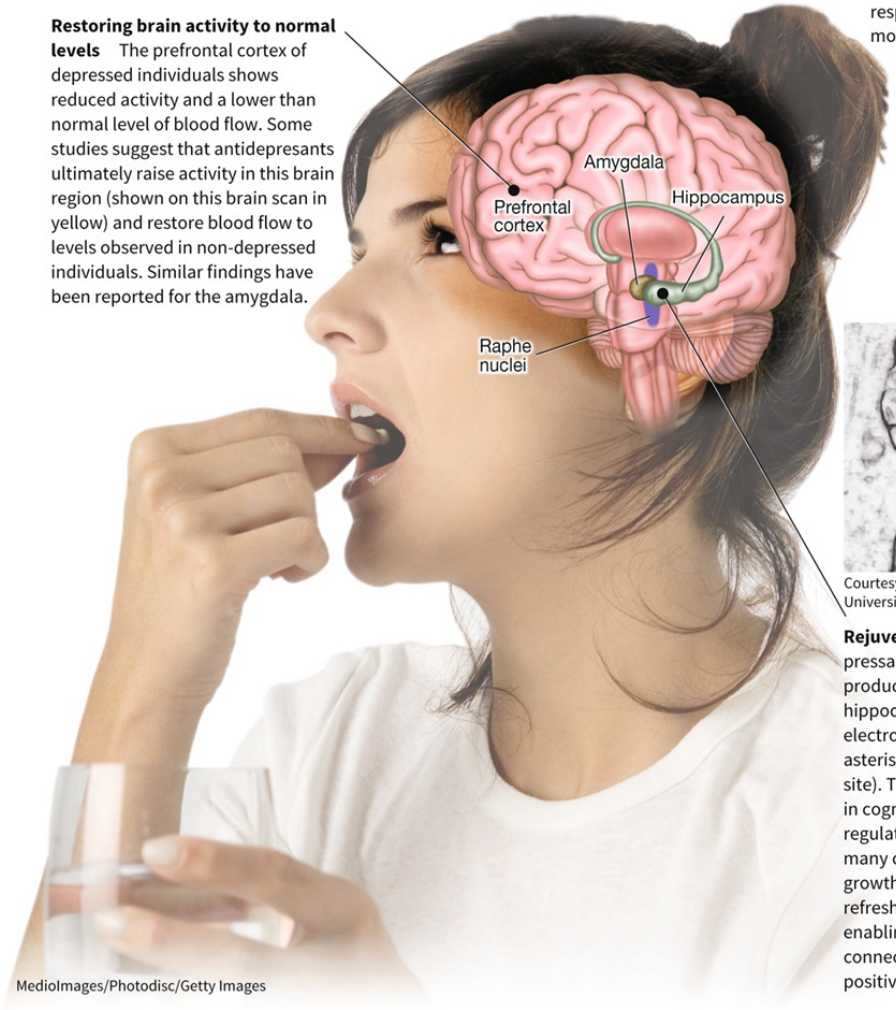
Newscom

From Paul Keedwell, Journal of Psychopharmacology 23(7):775-88, Figure 3, 2009, Sage Publications. ©2009 British Association for Psychopharmacology.

Restoring brain activity to normal levels The prefrontal cortex of depressed individuals shows reduced activity and a lower than normal level of blood flow. Some studies suggest that antidepresants ultimately raise activity in this brain region (shown on this brain scan in yellow) and restore blood flow to levels observed in non-depressed individuals. Similar findings have been reported for the amygdala.



Blocking serotonin reuptake By blocking key receptors, SSRIs prevent the reuptake, or retention, of serotonin by presynaptic neurons (shown in this illustration), thus freeing the neurotransmitter to better activate brain regions that are targets of serotonin axons, including the hippocampus and cerebral cortex. Depression relief, however, usually does not occur until someone has taken the drug for a few weeks, suggesting that some other mechanism may also be responsible for improving mood.



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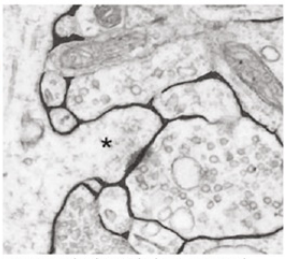


Courtesy Charles Nicholson, New York University School of Medicine

Rejuvenating the mind Antidepressant use stimulates the production of synapses in the hippocampus (shown here in this electron micrograph, with the asterisk indicating a postsynaptic site). The hippocampus plays a role in cognitive function and in regulating anxiety (a feature in many cases of depression). The growth of new synapses may refresh this important brain region, enabling the formation of new connections to support a more positive outlook.

Electroconvulsive Therapy

Another form of biological treatment is **electroconvulsive therapy (ECT)**, a technique first developed in the 1930s. ECT is used primarily for people who have severe depression. ECT is administered in the following manner. First, a strong muscle relaxant and usually a short-acting anesthetic are administered. Next, two electrodes are attached to the patient's forehead, and 65 to 140 volts of electricity are briefly passed through the brain (Pinna et

al., 2018). The procedure produces a brain seizure that lasts up to a few minutes. After an average of seven to nine ECT sessions, spaced two or three days apart, many patients feel considerably less depressed (see photo). ECT helps approximately 70 percent of depressed patients to improve (Perugi et al., 2012).

electroconvulsive therapy (ECT) use of electric shock to trigger a brain seizure in hopes of relieving abnormal functioning.

Will & Deni McIntyre/Science Source

ECT today As we can see with this patient, today's ECT treatments are conducted with considerable medical care and many safety precautions, and include procedures that help patients sleep throughout the procedure.

ECT is administered less often today than it was in the past, and is typically only used in treating severe depression that has not responded to other treatments. The procedure can negatively affect short-term memory (Merkl et al., 2011). Most such memories return, but some people who have gone through ECT report ongoing memory difficulties (Kroes et al., 2014; Freeman, Waite, & Easton, 2013). With the growing success of antidepressant medications and other forms of psychotherapy, fewer depressed patients now need this form of treatment. Nevertheless, ECT continues to be a viable treatment option when people have a severe depressive episode that does not respond to other forms of treatment or when they are suicidal. ECT is particularly effective in acute cases because it exerts a much more immediate effect than antidepressant drugs (McLoughlin, Kolshus, & Jelovac, 2017; Kellner et al., 2016).

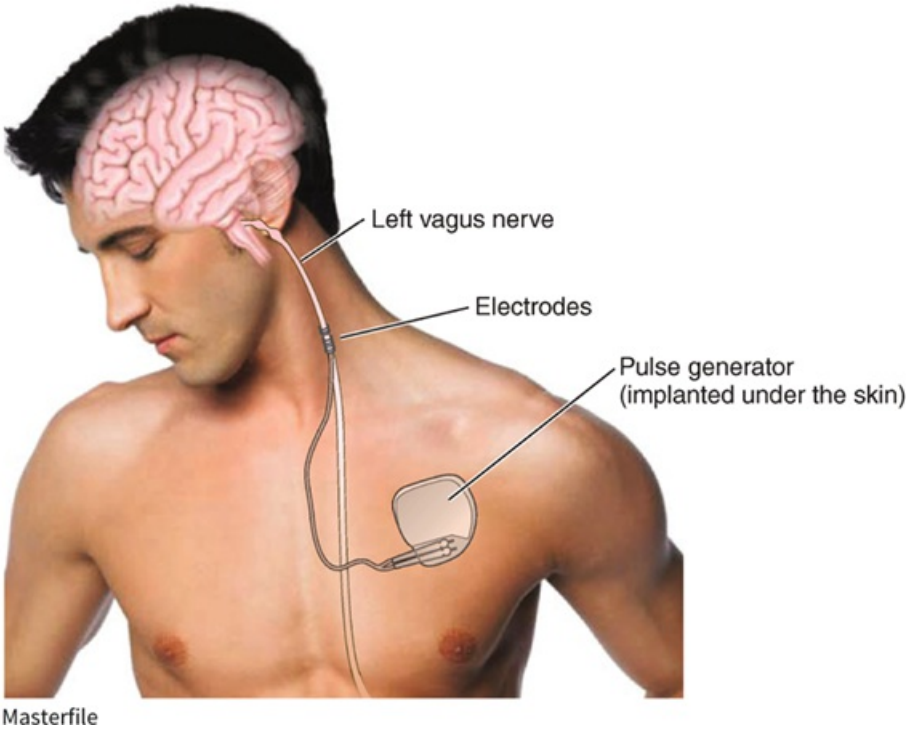
Although there is evidence to indicate that ECT is an effective treatment option in some cases of severe depression, for some the use of this treatment is contentious because the mechanism by which it alters mood is not well understood. Proponents argue that the seizure reestablishes biochemical and hormonal homeostasis in the brain in systems that control mood (Krishnan, 2016; McCall, Andrade, & Sienaert, 2014).

In recent years, two other biological approaches have been developed that also directly stimulate the brain. These approaches are *vagus nerve stimulation* and *transcranial magnetic stimulation*. These approaches appeal to many patients and clinicians because they are applied without the unpleasant side effects commonly associated with ECT.

Vagus Nerve Stimulation

The vagus nerve, the longest nerve in the human body, runs from the brain stem through the neck, down the chest, and on to the abdomen. In the **vagus nerve stimulation** procedure, a surgeon implants a small pacemaker-like device called a *pulse generator* under the skin of the chest. The surgeon then guides a wire, which extends from the pulse generator, up to the neck and attaches it to the left vagus nerve (see **Figure 16.2**). Electrical signals travel periodically from the pulse generator through the wire to the vagus nerve. In turn, the stimulated vagus nerve delivers electrical signals to the brain. These signals affect the mood centres of the brain.

vagus nerve stimulation a procedure in which an implanted device sends electrical signals to the brain through the vagus nerve; used to treat severe depression.



Masterfile

FIGURE 16.2 Vagus nerve stimulation In this procedure, an implanted pulse generator sends electrical signals to the left vagus nerve. That nerve then delivers

electrical signals to the brain, helping to reduce depression in many people.

In 1997, Health Canada approved the vagus nerve stimulation procedure for treating cases of otherwise intractable epilepsy. In 2001, after noting significant increases in positive mood in epileptics receiving the treatment, it was approved as a long-term treatment for severe treatment-resistant depression (Pisapia & Baltuch, 2015). Since this time, some research has found that the vagus nerve stimulation procedure provides significant symptomatic relief in as many as 65 percent of treatment-resistant depression cases (Howland et al., 2011).

Transcranial Magnetic Stimulation

In the **transcranial magnetic stimulation (TMS)** procedure, first developed in 1985, the clinician places an electromagnetic coil on or above the patient's head. The coil sends a current into the prefrontal cortex (Rotenberg, Horvath, & Pascual-Leone, 2014) (see photo). At least some parts of the prefrontal cortex of depressed people are underactive. TMS appears to increase neuron activity in those regions, thus helping to alleviate severe depression in about 65 percent of patients after it has been administered daily for two to four weeks (Perera et al., 2016). TMS was approved as a treatment option for major depressive disorder by Health Canada in 2002 (Blumberger & Daskalakis, 2016).

transcranial magnetic stimulation (TMS) a procedure in which an electromagnetic coil placed on or above a person's head sends a current into the prefrontal cortex; used to treat severe depression.

Boston Globe/Getty Images

Transcranial magnetic stimulation TMS is a non-invasive procedure used to treat depression. The electromagnetic coil is placed on the patient's head and sends a current into the prefrontal cortex.

Winfried Rothermel/AP

Early roots of psychosurgery? The hole in this 5100-year-old skull indicates that the individual underwent trephining, cutting away a circular section of the skull. Some historians believe that trephination was done to release the evil spirits that were thought to be responsible for mental dysfunction.

Psychosurgery

From time to time throughout the book, we have mentioned **psychosurgery**—brain-surgery procedures that can help some people with psychological disorders. Actually, the first use of brain surgery as a treatment for mental disorders was **trephining**, the prehistoric practice of chipping a hole in the skull to treat an injury or other disorder. Evidence indicates that trephining was used from prehistoric to medieval times (see photo).

psychosurgery brain surgery often used in hopes of relieving abnormal functioning.

trephining prehistoric practice of chipping a hole in the skull as a treatment for various brain conditions.

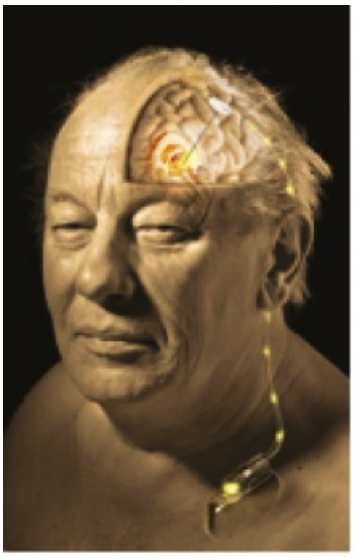
Many modern forms of psychosurgery are derived from a historic technique known as a **lobotomy**. In this procedure, the surgeon cuts the connections between the brain's frontal lobes and the lower centres of the brain. Lobotomies were widely used for a few decades after the procedure was developed in the 1930s, particularly in cases of schizophrenia. By the late 1950s, however, it had become clear that lobotomies were not as effective as many psychosurgeons had been claiming. Moreover, many patients who had undergone the surgery later suffered serious, irreversible effects to their intellect and personalities, including seizures, extreme listlessness, stupor, and in some cases, surgery resulted in death (Terrier, Lévêque, & Amelot, 2019; Barahal, 1958). Thus, use of this procedure declined during the mid- to late-1950s and 1960s as antipsychotic medications became more widely accepted and utilized (Schulkin, 2015).

lobotomy surgical practice of cutting the connections between the frontal lobe and the

lower centres of the brain.

Psychosurgery today is much more precise than the lobotomies of the past. It has fewer negative effects, and it is beneficial for some psychological and neurological disorders. One form of psychosurgery that is currently receiving considerable attention is **deep brain stimulation**—a procedure applied in cases of severe depression, Parkinson's disease, and brain seizure disorder (epilepsy). In deep brain stimulation, a surgeon drills two tiny holes into the patient's skull and implants electrodes in areas of the brain that have been implicated in the disorder. The electrodes are connected to a battery, or "pacemaker," that is implanted in the patient's chest (for men) or stomach (for women). The pacemaker powers the electrodes, sending a steady stream of low-voltage electricity to the problematic brain areas (Miocinovic, Somayajula, Chitnis, & Vitek, 2013; see images). In many cases, this repeated stimulation readjusts the person's brain activity and, over time, brings significant improvement (Chen et al., 2013; Blomstedt et al., 2011; Hamani et al., 2011). Although such implants have offered promising results, at present they are still considered experimental. Thus, this approach is used infrequently, particularly in cases of depression, and usually only after the severe disorder has continued for years without responding to other forms of treatment.

deep brain stimulation a procedure in which implanted electrodes deliver constant low stimulation to a small area of the brain; used to treat severe depression, Parkinson's disease, and epilepsy.



Tim Vernon, LTH NHS Trust/Science Source

Zephyr / Science Source

Deep brain stimulation **To treat severe cases of depression, Parkinson's disease, and epilepsy, electrodes are surgically implanted in the patient's brain to deliver constant low stimulation to adjust brain activity.**

Biological Treatments in Perspective

Biological treatments for psychological disorders, particularly drug treatments, are very

popular. They often bring great relief when other approaches have failed. However, the treatments have key limitations. As you have read, they can produce significant side effects. Moreover, more often than not, biological interventions alone are not a sufficient treatment for psychological disorders (Emmelkamp et al., 2014; Rosenberg & Kosslyn, 2014). Indeed, as we have seen throughout the textbook, the connections in our brains unfold partly in response to the environmental experiences that we have all through our lives, beginning in utero (Sale, Berardi, & Maffei, 2014).

Evidence is mounting, in fact, that just as behaviour can respond to changes in our brain chemistry, so too does our brain chemistry respond to changes in behaviour. One study, for example, found that people with depression who responded to psychotherapy came to show brain responses similar to those of healthy, non-depressed individuals. In contrast, depressed individuals who did not respond to psychotherapy continued to show the abnormal brain patterns that typically accompany depression (Yoshimura et al., 2014). In short, just as negative experiences can interact with brain activity to produce abnormal functioning, positive experiences can interact with the brain to make our functioning more normal (Lopizzo et al., 2015).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

4. What are the three main categories of biological treatments?

5. What are some new methods of direct brain stimulation, and how are they used?

What Do You Think? • Are today's clinicians and their clients too reliant on drugs as a treatment? Why or why not?

Psychodynamic Therapies

LEARNING OBJECTIVE 3

Describe the psychodynamic treatments for psychological disorders.

Following the principles of the psychodynamic model, psychodynamic therapists contend that today's emotional disorder is the result of yesterday's emotional trauma. A variety of psychodynamic therapies are now being practised, ranging from classical *Freudian psychoanalysis* to modern therapies such as *short-term psychodynamic therapy* and *relational psychoanalytic therapy*. All share the goals of helping clients to uncover past traumatic events and the inner conflicts that have resulted from them; to resolve, or settle, those conflicts; and to resume interrupted personal development. Psychodynamic therapists of different theoretical persuasions might focus on different conflicts, but they tend to use similar techniques.

Techniques of Psychodynamic Therapies

Psychodynamic therapists try to subtly guide their discussions with clients so that the clients discover their underlying problems for themselves (see photo). How do they do this? In part, they rely on such techniques as *free association*, *therapist interpretation*, *catharsis*, and *working through* (Gabbard, 2017; Summers & Barber, 2013).

Wavebreak Media ltd / Alamy Stock Photo

Psychodynamic techniques In order to help clients come to an appropriate understanding of their underlying problems, psychodynamic therapists interpret what the clients tell them.

Free Association

In psychodynamic therapies, the client is responsible for starting and leading each discussion. The therapist tells the individual to describe any thoughts or feelings that come to mind, even if they seem unimportant. This is the process known as **free association**. The therapist then probes the client's associations in the hope that they will eventually reveal the unconscious events that underlie the individual's problem.

free association psychodynamic therapy technique of allowing clients to freely talk about whatever they want.

Therapist Interpretation

Psychodynamic therapists share their interpretations of a client's associations with the client only when they think the individual is ready to hear them. The interpretations of three phenomena—*resistance*, *transference*, and *dreams*—are thought to be of special value.

Resistance Individuals demonstrate **resistance** when they encounter a block in their free associations or change the subject to avoid a potentially painful discussion. The

therapist remains on the lookout for resistance, which is usually unconscious, and may point it out to the client and interpret it.

Transference Psychodynamic therapists also believe that clients act and feel toward the therapist as they do toward important figures in their lives, past and present. This displacement of feelings is called **transference**. By interpreting transference behaviour, therapists may help individuals better understand how they unconsciously feel toward a parent or some other key person.

Dream interpretation Freud (1924) called dreams the "royal road to the unconscious." He believed that repression and other defence mechanisms operate ineffectively during sleep. Thus, a client's dreams can help reveal the person's unconscious instincts, needs, and wishes. Of course the dreams must be correctly interpreted. Freud distinguished a dream's *manifest content* (the consciously remembered dream) from its *latent content* (the symbolic meaning).

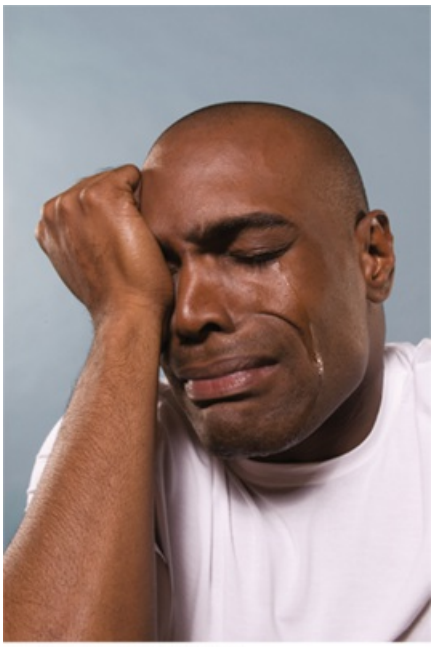
resistance practice in which clients encounter a block in their free associations or change the subject to avoid a potentially painful discussion.

transference process through which clients come to act and feel toward the therapist as they did toward important figures in their childhood.

Catharsis

Psychodynamic therapists believe that individuals must experience **catharsis** if they are to resolve internal conflicts and overcome their problems. That is, they must re-experience their past repressed feelings. Emotional catharsis must accompany intellectual insight for genuine progress to be achieved.

catharsis reliving of past repressed feelings as a means of settling internal conflicts and overcoming problems.



PM Images/Getty Images

Catharsis **Patients must re-experience past feelings in order to resolve internal conflicts and overcome their problems. Catharsis must be accompanied by intellectual insight.**

Working Through

A single session of interpretation and catharsis will not change a person. For deep and lasting insight to be gained, the client and therapist must *work through*, or examine, the same issues over and over, across many sessions, trying on the insights offered through therapy, each time with new and sharper clarity (Gabbard, 2017; Summers & Barber, 2013).

Short-Term Psychodynamic Therapies

It should be clear by now that Freud's psychoanalytic therapy takes time. However, over the years the public and health care providers increased their demand for more efficient, time-limited psychotherapies. The pressure for briefer therapy is also present in Canada, though driven more by limits of coverage for therapy either through employee assistance programs or health care insurance providers. As a result, several efforts emerged to make psychodynamic therapy shorter, more efficient, and more cost-effective. In brief versions of psychodynamic therapy, called *short-term psychodynamic therapy*, clients focus on a single problem—a *dynamic focus*—such as excessive dependence on other people (Wolitzky, 2011). The therapist and client centre their discussions on this problem and work only on issues that relate to it. A relatively small number of studies have tested the effectiveness of these short-term psychodynamic therapies. Their findings, however, suggest that the approaches are sometimes quite helpful (Fjeldstad, Høglend, & Lorentzen, 2015; Wolitzky, 2011).

Relational Psychoanalytic Therapy

Whereas Freud believed that psychodynamic therapists should take on the role of a neutral, distant expert during a treatment session, a current school of psychodynamic therapy called **relational psychoanalytic therapy** argues that therapists are key figures in the lives of clients—figures whose reactions and beliefs should be directly included in the therapy process (Luborsky, O'Reilly-Landry, & Arlow, 2011). Thus, a key principle of relational psychoanalytic therapy is that therapists should also disclose things about themselves, particularly their own reactions to patients, and try to establish more equal relationships with clients as opposed to the distant analytic relationships typical of standard psychoanalysis (Curtis & Hirsch, 2011).

relational psychoanalytic therapy a school of psychodynamic therapy holding that therapists should work to form more equal relationships with clients.

Psychodynamic Therapies in Perspective

Freud and his followers have had a major impact on treatment. They were the first practitioners to demonstrate the value of systematically applying both theory and techniques to treatment. Moreover, their approaches were the first to clarify the potential of psychological, as opposed to biological, treatment. In fact their ideas have served as a starting point for many other psychological treatments (Gabbard, 2017; Summers & Barber, 2013).

The efficacy of psychodynamic therapies has been debated, with some researchers reporting a lack of effectiveness (Wampold, Hollon, & Hill, 2011), while others report significant data indicating that psychodynamic psychotherapy is superior to, or at least as effective as, other therapeutic approaches (Steinert et al., 2017; Shedler, 2010), especially for short-term psychodynamic psychotherapy (Driessen et al., 2015) (see Psychology Around Us 16.1). For the first half of the twentieth century, the value of these approaches was supported mostly by the case studies of enthusiastic clinicians and by uncontrolled research studies. Controlled investigations have been conducted only since the 1950s, and, with the exception of short-term psychodynamic therapies, only a small number of such studies have found psychodynamic therapies to be more effective than no treatment or placebo treatments (Shedler, 2010), although other studies report that longer term psychodynamic therapies are more effective than short-term psychodynamic therapies (Huber et al., 2013). Currently, approximately, 15 percent of today's clinical psychologists identify themselves as psychodynamic therapists (Sharf, 2012; Prochaska & Norcross, 2010).

16.1 Psychology Around Us

Psychodynamic Treatments for Borderline Personality Disorder

Personality disorders have been historically very difficult to treat, except for third-wave cognitive behavioural therapeutic approaches such as dialectic behaviour therapy (see Positive Psychology 16.1), and they are often unresponsive to common mood and anxiety treatments (Keefe et al., 2018; McMain et al., 2012). Borderline personality disorder in particular is marked by ongoing volatility in mood, unstable

relationships, and impulsive behaviour. Among other symptoms, persons diagnosed with this disorder often experience feelings of emptiness, paranoid thoughts, and intense anger issues, making this disorder difficult to treat over the long term. Shelly McMain at the University of Toronto and colleagues from the United States, Germany, and Israel carried out a systematic meta-analysis evaluating the effectiveness of psychodynamic therapies as a way of treating personality disorders (Keefe et al., 2020). Although psychodynamic therapies have been claimed by therapists to facilitate or predict improvements in general functioning and to reduce undesirable symptoms in those diagnosed with borderline personality disorder (Høglend & Hagtvet, 2019), prior to this evaluation, no comprehensive meta-analysis had been undertaken of previous studies examining psychodynamic therapy used with clients comprising this population. In short, the study showed no significant advantage of psychodynamic approaches over other legitimate approaches during active therapy but did show more lasting effects at the post-treatment follow-up. The authors stated a need for additional studies with more rigorous control groups.

Katarzyna Białasiewicz/123 RF

Personality disorder This condition is characterized by extreme, unstable moods and strong emotional reactions.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

6. Contrast three types of psychodynamic therapy.

7. List and describe psychodynamic therapy techniques.

What Do You Think? • Remember Romy, in our chapter opener. In treating Romy's psychological distress, where might a Freudian psychoanalyst start? Would this analyst be likely to achieve the results described in the time frame identified? Why or why not?

Behavioural Therapies

LEARNING OBJECTIVE 4

Describe the behavioural treatments for psychological disorders.

Behavioural theories and treatments today are usually part of the *cognitive-behavioural model*—the perspective that combines behavioural and cognitive principles to explain and treat psychological disorders. For many years, however, behavioural treatments were applied on their own, and, even today, there are times when behavioural interventions alone are sufficient to treat certain problems. Thus, in this section we will look at behavioural therapies exclusively. We will then move on to cognitive-behavioural therapies in the next section.

As you may recall from Chapter 15, behaviourists contend that the symptoms of a psychological disorder are learned behaviours acquired through the same conditioning processes that produce normal behaviours (Staddon, 2014). The goal of behavioural therapy is to identify the client's specific problem-causing behaviours and to replace them with more adaptive behaviours. The therapist's attitude toward the client is that of a teacher, rather than a healer. Behavioural techniques fall into three categories: *classical conditioning*, *operant conditioning*, and *modelling*.

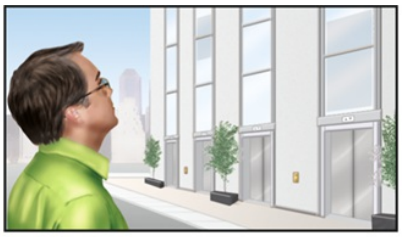
Classical Conditioning Techniques

Classical conditioning treatments are intended to change clients' dysfunctional reactions to stimuli. One treatment, described in Chapter 7, is *systematic desensitization*. This step-by-step process is aimed at teaching people with phobias to react with calm instead of fear to the objects or situations they dread (Fishman, Rego, & Muller, 2011; Wolpe, 1997a, 1997b, 1995, 1990). Clients first are trained in deep-muscle relaxation, through deep breathing, calming mental imagery, and systematic tensing and releasing of muscles. Next, they construct a *fear hierarchy* in which they list objects or situations associated with their phobia, starting with the least feared and ending with the most feared. For a client with a phobia of elevators, for example, looking at an elevator on the outside of a building a block away might be low on the fear hierarchy; watching the elevator doors close while inside the elevator might be near the top (see **Figure 16.3**). Finally, either in imagination or physically, clients confront each item on the hierarchy while they are in a state of deep relaxation, starting with the least fearful and then moving on up the list.

Least

Amount of anxiety

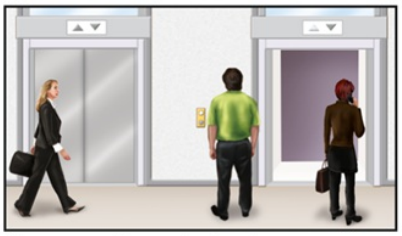
Most



Looking at a building with outside elevators

Approaching a bank of elevator doors

Pressing the elevator call button



Doors open to empty elevator

Stepping onto elevator with a few other people

In a crowded elevator as doors close

FIGURE 16.3 Fear hierarchy Systematic desensitization uses classical conditioning principles to reduce a person's fears. Starting with the least stressful situation on his fear hierarchy, a man with a fear of riding in an elevator is exposed to each item on the hierarchy while applying relaxation techniques.

Source: Table 17-2: Reprinted with permission of John Wiley & Sons, Inc., from Kowalski, R., & Westen, D. (2009). *Psychology* (5th ed.). Hoboken, NJ: Wiley, p. 574.

Research has repeatedly found that systematic desensitization and other classical conditioning techniques reduce phobic reactions more effectively than placebo treatments or no treatment at all (Olatunji et al., 2011; Kraft & Kraft, 2010). These techniques have also been helpful in treating several other kinds of problems, including sexual dysfunctions, posttraumatic stress disorder, agoraphobia, and asthma attacks (Foa & McLean, 2016). Because desensitization techniques expose individuals to the objects or situations they fear, and because this exposure seems so critical to implement, these and related approaches are often referred to as *exposure* treatments (Maren & Holmes, 2016; Abramowitz, 2013).

An opposite use of classical conditioning is known as **aversion therapy**. Here, clients *acquire* anxiety responses to stimuli that they have been finding too attractive. As shown in **Figure 16.4**, this approach has been used with people who want to stop excessive drinking, for example, (Brewer, Streel, & Skinner, 2017). In repeated sessions, the clients may be given an electric shock, a nausea-producing drug, or some other noxious stimulus whenever they reach for a drink. Aversion therapy has also been applied to help eliminate such undesirable behaviours as sexual paraphilias, smoking, and self-multilation behaviours in children diagnosed with autism (Minshawi et al, 2015; Fisher & Maggi, 2014; Carim-Todd, Mitchell, & Oken, 2013). However, the effects of this approach are typically short-lived, especially for those individuals who are aware that it is the drugs and not the alcohol, smoking, or other behaviour that is actually causing their nausea (Zindel & Kranzler, 2014).

aversion therapy therapy designed to help clients to acquire anxiety responses to stimuli that the clients have been finding too attractive.

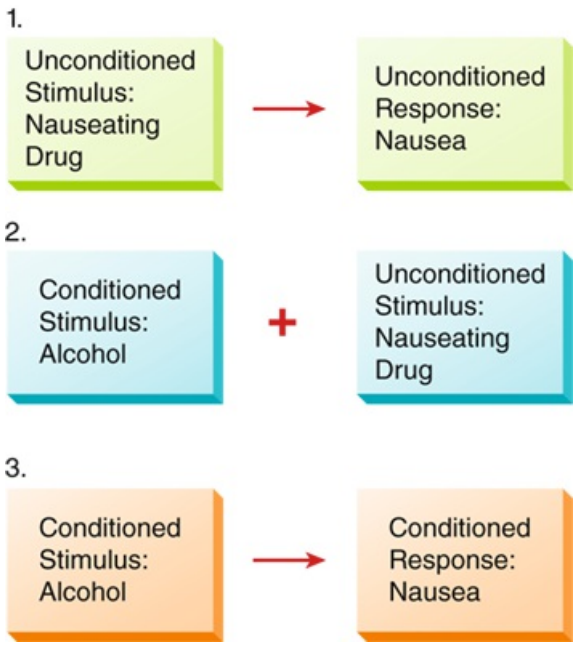


FIGURE 16.4 Aversion therapy **Aversion therapy uses classical conditioning principles to create a negative response to a stimulus a person would like to avoid, such as alcohol.**

Operant Conditioning Techniques

In operant conditioning treatments, therapists consistently provide rewards for appropriate behaviour and withhold rewards for inappropriate behaviour. This technique has been employed frequently, and often successfully, with hospitalized patients experiencing psychosis (Glynn, 2014). For example, when such patients speak coherently and behave normally, they are rewarded with food, privileges, attention, or something else they value. Conversely, patients receive no rewards when they speak bizarrely or display other psychotic behaviours.

Parents, teachers, and therapists have successfully used operant conditioning techniques to change problem behaviours in children (such as repeated tantrums) and to teach skills to individuals diagnosed with autism or intellectual disabilities (Hersen, Eisler, & Miller, 2016; Martin & Pear, 2016; Soorya, Carpenter, & Romanczyk, 2011). Rewards in such cases have included food, recreation time, social rewards, and television watching.

HD57life/Alamy Stock Photo

We're all familiar with token economies **The token economies applied in various mental health settings operate just like the star system that most of us were exposed to in elementary school. At school, however, good work was rewarded with stars instead of tokens, and numerous stars added up to a certificate instead of privileges, treats, or other rewards.**

Operant conditioning techniques typically work best in institutions or schools, where a person's behaviour can be reinforced systematically throughout the day. Often, an entire ward or classroom is converted into an operant conditioning arena. In many such programs, desirable behaviour is reinforced with tokens that can later be exchanged for food, privileges, or other rewards (Ayllon & Azrin, 1968). Programs of this sort are called **token economy** programs (Doll, McLaughlin, & Barretto, 2013) (see photo).

> **token economy** operant conditioning therapy program in which participants receive tokens (that can be traded for rewards) when they display desired behaviours.

Behavioural techniques based on operant conditioning have also been useful for treating depression (Lazzari, Egan, & Rees, 2011). Recall from Chapter 15 that depression is often associated with a decline in pleasant activities and withdrawal. To deal with these behaviours, therapists may work with depressed individuals to identify activities the clients enjoy and then guide the individuals in adding the activities back into their lives (Carvalho & Hopko, 2011).

Modelling Techniques

Modelling therapy was first developed by the pioneering Canadian-born social learning theorist Albert Bandura (1977, 1969). Here, therapists demonstrate appropriate behaviours for clients. Then the clients, through a process of imitation and rehearsal, acquire the ability to perform the behaviours in their own lives. This procedure has been used to treat phobias, for example. When therapists repeatedly display calm emotions

while confronting objects that are feared by phobic clients, many clients are able to overcome their phobias (Rosenthal & Bandura, 1978; Bandura, Adams, & Beyer, 1977).

Behavioural therapists have also used modelling to help people acquire or improve their social skills and assertiveness. In an approach called **social skills training**, for example, therapists point out the social deficits of clients and then role-play social situations with the clients, typically modelling more appropriate social behaviours for them. Ultimately, the clients practise the behaviours in real-life situations (Trower & Hollin, 2013). For example, the following dialogue demonstrates how a therapist might guide a client who is a male university student who has difficulty making dates with women:

Client: By the way, [Pause] I don't suppose you want to go out Saturday night?

Therapist: Up to actually asking for the date you were very good. However, if I were the girl, I think I might have been a bit offended when you said, "By the way." It's like you're asking her out is pretty casual. Also, the way you phrased the question, you were kind of suggesting to her that she doesn't want to go out with you. Pretend for the moment I'm you. Now, how does this sound: "There is a movie at the Varsity Theatre this Saturday that I want to see. If you don't have other plans, I'd very much like to take you."

Client: That sounded good. Like you were sure of yourself and liked the girl too.

Therapist: Why don't you try it.

Client: You know that movie at the Varsity? Well, I'd like to go, and I'd like to take you Saturday, if you don't have anything better to do.

Therapist: Well, that certainly was better. Your tone of voice was especially good. But the last line, "if you don't have anything better to do," sounds like you don't think you have too much to offer. Why not run through it one more time.

Client: I'd like to see the show at the Varsity, Saturday, and, if you haven't made other plans, I'd like to take you.

Therapist: Much better. Excellent, in fact. You were confident, forceful, and sincere.

(Rimm, D. C., & Masters, J. C. (1979). *Behavior therapy: Techniques and empirical findings* (2nd ed.). New York: Academic Press, p. 74.)

social skills training behavioural therapy technique in which therapists serve as models and teachers to help clients acquire desired social behaviours.

Aspenphoto/Dreamstime.com

Role-playing Asking someone on a date requires practice for some individuals.

Using a combined strategy of modelling, rehearsal, feedback, and practice, therapists have successfully taught social and assertion skills to shy, passive, or socially isolated people. These techniques can help people who have a pattern of violent outbursts after building up resentment (rather than asserting themselves) over perceived social slights (Lochman, Barry, Powerll, & Young, 2010). The approach has also been used to improve the social skills of children and adults who experience depression, anxiety, or other psychological problems (Ogden, 2011; Ishikawa et al., 2010).

Behavioural Therapies in Perspective

Behavioural interventions have been among the most widely researched treatment approaches in the clinical field (Wilson, 2011). Certainly, they lend themselves to research more than the psychodynamic approaches do. The removal of symptoms—the criterion of progress in behavioural therapy—is easier to observe and measure than the largely internalized criterion of conflict resolution—the psychodynamic criterion of improvement. Moreover, behavioural approaches have been demonstrated to be effective for numerous problems, including reducing or eliminating specific fears, minimizing social deficits, and addressing issues arising from intellectual disabilities (Nathan & Gorman, 2015; Wilson, 2011).

Cynthia Dopkin/Science Source

Behavioural interventions **Time out is a popular behavioural technique for disciplining young children and is largely effective due to its focus on a specific and current behaviour.**

At the same time, behavioural therapies have certain limitations. First, the improvements they bring about do not always maintain themselves without further interventions (see photo). Second, behavioural therapies, by themselves, do not appear to be particularly effective when psychological disorders are broad or vaguely defined. Problems involving generalized anxiety, for example, are unlikely to be alleviated by step-by-step, behaviour-by-behaviour interventions (Wilson, 2011). This failure to address some types of psychological disorders is one of the reasons behavioural interventions are now usually combined with cognitive approaches.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

8. What are systematic desensitization and aversion therapy?

9. What principles and procedures are involved in a token economy program?

10. How does social skills training work?

What Do You Think? • Does changing behaviour fully treat people's disorders?

Cognitive-Behavioural Therapies

LEARNING OBJECTIVE 5

Describe cognitive-behavioural therapies for psychological disorders.

Working from the assumption that dysfunctional thinking is at the centre of many psychological disorders, cognitive-behavioural therapists try to help people recognize and change their faulty thinking processes. Because different disorders involve different kinds of cognitive dysfunction, therapists may employ a range of cognitive strategies. Most such therapists also use some behavioural techniques to help clients think, behave, and feel better. Thus, this approach is typically referred to as cognitive-behavioural. Three influential cognitive-behavioural approaches are those of Albert Ellis, Aaron Beck, and the "second-wave" cognitive-behavioural therapists (who use approaches focused on the present; see Cristea et al., 2013).

Ellis's Rational-Emotive Behavioural Therapy

In line with his belief that irrational assumptions give rise to abnormal functioning, Albert Ellis developed an approach called **rational-emotive behavioural therapy** (Ellis, 2013, 2011, 2005, 1962). Therapists using this approach first help clients identify the irrational assumptions that seem to govern their behavioural and emotional responses. Next, they help clients change those assumptions into constructive ways of viewing themselves and the world. One of the techniques the therapists may use is *cognitive restructuring*, in which clients learn to replace negative interpretations with more positive notions (Clark, 2013) (see **Figure 16.5**).

rational-emotive behavioural therapy Ellis's therapy technique designed to help clients discover and change the irrational assumptions that govern their emotions, behaviours, and thinking.

FIGURE 16.5 Cognitive restructuring This cognitive strategy can help clients change self-defeating thinking and, in turn, open the door to new, more positive life experiences.

In his own practice, Ellis would point out to clients their irrational assumptions in a blunt, confrontational, and often humorous way. Then he would model the use of alternative assumptions. After criticizing a young man's perfectionistic standards, for example, he might say, "So what if you did a lousy job on that paper? It's important to realize that one lousy paper simply means one lousy paper, and no more than that!" Ellis gave clients homework assignments requiring them to observe their assumptions at work in their everyday lives. He also required them to think of ways to test the rationality of the assumptions. And, finally, he had them rehearse new assumptions during therapy and apply them at home and work.

Research evaluating the effectiveness of rational-emotive therapy suggests that this form of therapy has been demonstrated to be an effective means of addressing issues for those who suffer from anxiety or assertiveness issues. For example, clients with social anxiety who are treated with this therapy improve more than socially anxious clients who receive no treatment or placebo treatments (Dryden, 2014).

Beck's Cognitive Therapy

Aaron Beck independently developed a system of therapy that is similar to Ellis's rational-emotive behavioural therapy. Although he named his approach **cognitive therapy**, Beck has emphasized for decades that he also has clients experiment with new behaviours as a key feature of the approach.

cognitive therapy Beck's cognitive therapy technique designed to help clients recognize and change their dysfunctional thoughts and ways of thinking.

This approach has been used most often with people who are depressed, although it also has been applied to problems ranging from panic disorder to personality disorders (Beck, Davis, & Freeman, 2015; Milrod et al., 2015; Beck & Weishaar, 2011). In their work with depressed clients, Beck-like cognitive therapists help clients to identify the negative thoughts and errors in logic that pervade their thinking and help give rise to feelings of depression. The therapists also teach clients to challenge their dysfunctional thoughts, try new interpretations, and apply different ways of thinking in their daily lives. In the following excerpt, Beck guides a depressed 26-year-old graduate student to see the link between the way she interprets her experiences and the way she feels, and to begin questioning the accuracy of her interpretations.

Patient: I get depressed when things go wrong. Like when I fail a test.

Therapist: How can failing a test make you depressed?

Patient: Well, if I fail I'll never get into law school.

Therapist: So failing the test means a lot to you. . . . Did everyone who failed get depressed enough to require treatment?

Patient: No, but it depends on how important the test was to the person.

Therapist: Right, and who decides the importance?

Patient: I do . . .

Therapist: Now what did failing mean?

Patient: (Tearful) That I couldn't get into law school.

Therapist: And what does that mean to you?

Patient: That I'm just not smart enough.

Therapist: Anything else?

Patient: That I can never be happy.

Therapist: And how do these thoughts make you feel?

Patient: Very unhappy.

Therapist: So it is the meaning of failing a test that makes you very unhappy. [Moreover] you get yourself into a trap—by definition, failure to get into law school equals "I can never be happy."

(Beck, A. T., Rush, A. J., Shaw, B. F., & Emery, G. (1979). *Cognitive therapy of depression*. New York: Guilford Press, pp. 145–146.)

Around two-thirds of depressed people who are treated with Beck's cognitive approach improve (see photo). This is significantly more than those who receive no treatment and about the same as those who receive biological treatments (Beck & Weishaar, 2011; Disner et al., 2011). Research also indicates the effectiveness of Beck-like cognitive therapy in cases of panic disorder and social anxiety disorder (Jazaieri, Goldin, & Gross, 2016; Milrod et al., 2015).

CebotariN/Shutterstock.com

Depression **Cognitive therapy is effective at identifying the negative thoughts and errors in logic that permeate the thinking of depressed individuals.**

Second-Wave Cognitive-Behavioural Therapies

A growing body of research suggests that the kinds of cognitive changes proposed by Ellis, Beck, and other cognitive therapists are not always possible to achieve (Sharf, 2012). Thus, a new group of cognitive-behavioural therapies, sometimes called *second-wave* cognitive-behavioural therapies, has emerged (Hollon & DiGiuseppe, 2011). These approaches help clients to *accept* many of their problematic thoughts rather than judge them, act on them, or try fruitlessly to change them. The hope is that by recognizing such thoughts for what they are—just thoughts—clients will eventually be able to let them pass through their awareness without being particularly troubled by them.

One of several disorders to which this kind of approach has been applied is generalized anxiety disorder. As you read in Chapter 15, this disorder is characterized by persistent and excessive feelings of anxiety and endless worrying about numerous events and activities. Second-wave cognitive-behavioural therapists guide clients with generalized anxiety disorder to recognize and then accept their dysfunctional uses of worrying (Newman et al., 2011; Ritter, Blackmore, & Heimberg, 2010; Wells, 2010). They begin by educating the clients about the role of worrying in their disorder and have them observe their bodily arousal and cognitive responses across various life situations. Over time, the clients come to appreciate the triggers of their worrying, their misconceptions about worrying, and their misguided efforts to control their lives by worrying. As their insights grow, clients are expected to see the world as less threatening (and so less arousing), try out more constructive ways of dealing with arousal, and, perhaps most important, worry less about the fact that they worry so much. Research has begun to indicate that a concentrated focus on worrying of this kind is indeed a helpful addition to the treatment of generalized anxiety disorder (Bystritsky, Khalsa, Cameron, & Schiffman, 2013; Ritter et al., 2010; Wells, 2010).

Currently, a third wave of cognitive-behavioural approaches focuses on processes associated with health and well-being, such as mindfulness, acceptance, spirituality, and

other ways in which individuals become aware of their thoughts in non-judgmental ways. One example of this, *mindfulness-based cognitive therapy*, developed by psychologist Steven Hayes and his colleagues as part of their broader treatment approach called *acceptance and commitment therapy* (Antony, 2011; Treanor, 2011), helps clients to become mindful of their streams of thoughts—including their worries—at the very moments they are occurring, and to *accept* such thoughts as mere events of the mind. By accepting their thoughts rather than trying to eliminate them, clients are expected to be less upset and affected by them.

Mindfulness-based cognitive therapy has also been applied to psychological problems such as depression, posttraumatic stress disorder, personality disorders, and substance abuse, often with promising results (Johnson et al., 2016; King & Favorite, 2016; Kuyken et al., 2016). The approach borrows heavily from a form of meditation called *mindfulness meditation*, which teaches individuals to pay attention to the thoughts and feelings that flow through their minds during meditation and to accept such thoughts in a non-judgmental way. See Positive Psychology 16.1 for further information on mindfulness and third-wave cognitive behavioural approaches.

16.1 Psychology Around Us | Positive Psychology

Third-Wave Cognitive-Behavioural Therapy

Cognitive behavioural therapies (CBTs) are a group of associated psychotherapies that share a core belief that cognitions and emotions may lead to dysfunctional behaviours. The overall aim of cognitive behavioural therapeutic interventions is to help clients reduce or eliminate undesirable thoughts and emotions.

The "family" of CBTs evolved over time. Behavioural therapy's "first wave" was characterized by applying the traditional concepts of operant and classical conditioning—focusing on changing overt behaviours using basic learning and conditioning paradigms. The "second wave" of CBTs was initiated by psychologists such as Albert Ellis and Aaron Beck, who demonstrated how an individual's internalized (covert) thoughts and beliefs affected their behaviours and emotional experiences.

More recent "third-wave" cognitive behavioural therapies view individuals as capable of growth and change and, rather than treating mental illness or maladaptive behaviour using issue-focused approaches, they value holistic approaches. The idea is that once an individual sees the entire picture of their well-being, they are more likely to stop focusing on a single problem and instead focus on becoming a happier, more well-rounded human being. Therapists help clients to strive for rewarding and healthy mental lives using processes such as mindfulness, metacognition, acceptance, and compassion, and by emphasizing values, comprehensive life goals, and positive emotions. Third-wave approaches help clients to accept their thoughts without judging them as good or bad but to view them only as internal experiences. Evidence-based methodologies such as mindfulness based cognitive therapy, dialectical behaviour therapy, compassion focused therapy, and acceptance and commitment therapy are common approaches used by third-wave clinicians (Micallef-Trigona, 2018). Some

researchers have suggested that practitioners can best serve clients by employing methods from all three CBT waves and methods that are particularly effective with specific client populations (Wolitzky-Taylor, Arch, Rosenfield, & Craske, 2012). Other researchers have argued that the real value of third-wave approaches is their readiness to include aspects of other, less scientifically based approaches, such as psychoanalysis, Gestalt therapy, and humanism (Hayes & Hoffman, 2017).

In a review of the development of cognitive therapies for depression and the effectiveness of different approaches, Keith Dobson (2016), from the University of Calgary, addressed the efficacy of mindfulness as a third-wave therapy for the treatment of depression. Specifically, Dobson addresses the effectiveness of mindfulness based cognitive therapy (MBCT) as an intervention for relapse prevention. He argues that a basic assumption of MBCT is that depressed individuals respond not only to environmental triggers or stressors, but that they also think about, and regulate, thoughts about the depression itself. MBCT helps patients to be mindful (open, flexible, attentive) of these thoughts and to use this awareness as a way of resisting depression. Dobson cites literature acknowledging this approach as effective for patients, especially patients with recurrent depressive episodes, but he also cites research arguing that this approach is not always successful because depressed individuals are sometimes unable to accept negative processing (see Bondolfi et al., 2010). Therefore, Dobson argues that third-wave CBT approaches require further consideration for use with depression.

Cognitive-Behavioural Therapies in Perspective

A model that sees and treats thought as the main cause of normal and abnormal behaviour offers great appeal. Accordingly, therapists from varied backgrounds have come to embrace and use cognitive-behavioural approaches. Moreover, research has supported these approaches. Cognitive-behavioural therapies have proved very effective for treating depression, social anxiety disorder, generalized anxiety disorder, panic disorder, sexual dysfunctions, and a number of other psychological disorders (Beck & Weishaar, 2011).

But the cognitive-behavioural approaches also have their limitations. First, although disturbed cognitive functioning is found in many psychological disorders, its precise role has yet to be determined. It is not always clear that it is at the *centre* of various disorders. Correspondingly, it is not clear whether it is the behavioural or the cognitive features of the cognitive-behavioural approaches that most powerfully propel these treatments. The assumption of many therapists is that the behavioural features help bring about essential cognitive changes. But it could well be that in many cases and disorders, it is the behavioural changes that are most important. And, finally, although cognitive-behavioural therapies are certainly effective for many problems, they do not help everyone (Sharf, 2012).

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

11. What do therapists help clients to do in rational-emotive behavioural therapy?

12. What is cognitive therapy?

13. What are the goals of second-wave cognitive-behavioural therapies?

What Do You Think? • We all sometimes have irrational assumptions, though they don't usually cause psychological disorders. What irrational assumptions and thoughts do you occasionally have?

Humanistic and Existential Therapies

LEARNING OBJECTIVE 6

Describe the humanistic and existential therapies for psychological disorders.

Believing that psychological disorders are rooted in self-deceit, humanistic and existential therapists try to help clients look at themselves and their situations more accurately and acceptingly. They expect that clients will then be better able to actualize their full potential as human beings. To achieve this, humanistic and existential therapists usually emphasize present experiences rather than events from the client's past (Krug, 2019).

Rogers's Client-Centred Therapy

Clinicians who practise Carl Rogers's **client-centred therapy** try to create a positive climate in which clients can look at themselves honestly and acceptingly (Raskin et al., 2011). The therapist must display three important qualities throughout the therapy:

Unconditional positive regard—full and warm acceptance for the client.

Accurate empathy—skillful listening, including restatements of the client's own comments.

Genuineness—realness, sincere communication, no professional front or facade.

client-centred therapy humanistic therapy designed to help clients experience unconditional positive regard and look at themselves honestly and acceptingly.

According to Rogers, clients will feel accepted by their therapists in this kind of atmosphere. They will eventually come to recognize and value their own emotions, thoughts, and behaviours once again. They will then be freed from the insecurities that have been preventing self-actualization (Rogers, 1980). The following interaction shows a therapist using the techniques Rogers advocates:

Client: In classes I feel that everyone's just waiting for a chance to jump on me. . .. When I meet somebody I wonder what he's actually thinking of me. Then later on I wonder how I match up to what he's come to think of me.

Therapist: You feel that you're pretty responsive to the opinions of other people.

Client: Yes, but it's things that shouldn't worry me.

Therapist: You feel that it's the sort of thing that shouldn't be upsetting, but they do get you pretty much worried anyway.

Client: . . . There are lots of little things that aren't true. . . . Things just seem to be piling up, piling up inside of me. . . . It's a feeling that things were crowding up and they were going to burst.

Therapist: You feel that it's a sort of oppression with some frustration and that things are just unmanageable.

Client: In a way . . . . I'm afraid I'm not very clear here but that's the way it comes.

Therapist: That's all right. You say just what you think.

(Snyder, W. V. (1947). *Casebook of non-directive counseling*. Boston: Houghton Mifflin, pp. 2–4.)

iofoto/Shutterstock.com

An alternative source of unconditional positive regard **Based on the Rogerian principle that unconditional positive regard is highly therapeutic, pet therapy has become a widely applied intervention to help reduce the depression of people such as elderly nursing home residents. In this approach, individuals interact with various kinds of non-judgmental animals.**

Rogers was committed to clinical research, and his commitment helped promote the systematic study of treatment. There is not a great deal of research evidence for the efficacy of client-centred therapy; however, the core practices employed in client-centred therapy do have research support (Hoffman et al., 2016). Although some studies report improvements among people who receive this therapy, most controlled research finds it to be of limited effectiveness. Nevertheless, Rogers's therapy has had a very positive influence on the clinical field (Raskin et al., 2011). As one of the first major alternatives to psychodynamic therapy, it helped open up the field to new approaches (Miller, 2014) (see photo).

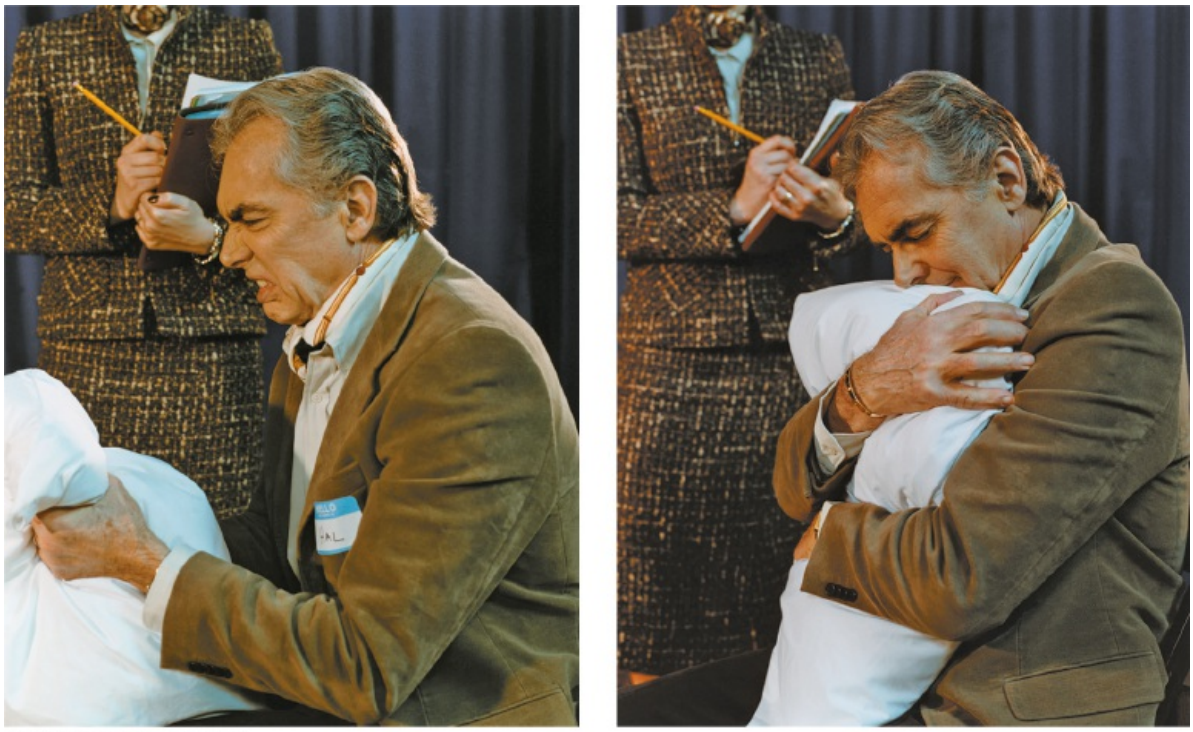
Gestalt Therapy

Gestalt therapy, another humanistic approach, was developed in the 1950s by clinical

theorist Frederick (Fritz) Perls. Gestalt therapists, like client-centred therapists, move clients toward self-recognition and self-acceptance (Yontef & Jacobs, 2011). But unlike client-centred therapists, they often try to do this by challenging and frustrating the clients. Perls's favourite techniques included skillful frustration, role playing, and rules.

> *Skillful frustration* Gestalt therapists consistently refuse to meet their clients' expectations or demands. The aim here is to help the clients to see how often they try to manipulate others into meeting their needs.
>
> *Role playing* Gestalt therapists often have clients act out various roles. A person may be instructed to be another person, an object, an alternate self, or even a part of the body. Role playing can become very intense, as individuals are encouraged to fully express their feelings. They may cry out, scream, kick, or pound. Eventually they are expected to "own," or accept, feelings that previously made them uncomfortable.
>
> *Rules* The rules enforced by Gestalt therapists ensure that clients look at themselves closely. In certain versions of this therapy, for example, clients may be required to use "I" language instead of "it" language. They must say, "I am sad" rather than "The situation is depressing."

Because Gestalt therapists believe that subjective experiences and self-awareness defy objective measurement, limited research has been conducted on the approach (Yontef & Jacobs, 2011). Recently, Gestalt techniques have been included in a group of other treatments referred to as *emotion-focused*. These treatments emphasize attention to one's current emotional experiences as a way to reduce anxiety, depression, and other psychological difficulties (Goldman, 2016) (see photos).



Pascal Preti/Getty Images

Gestalt techniques **Gestalt therapists often guide clients, such as this man, to**

express their needs and feelings to an extreme through role playing and other exercises. In this session, the client moves from "strangling" a pillow (left), to banging the pillow, to hugging it (right). The pillow may represent a person about whom the client has mixed feelings.

Existential Therapy

Existential therapists encourage clients to accept responsibility for their lives and their problems. They help clients to recognize their freedom so that they may choose different paths and live more meaningful lives (Yalom & Josselson, 2011; Schneider & Krug, 2010). Existential therapists also place great emphasis on the relationship between therapist and client, and try to create an atmosphere of honesty, shared learning, and growth.

Like Gestalt therapists, most existential therapists do not believe that experimental methods can properly test the effectiveness of their treatments (Yalom & Josselson, 2011). In fact, they hold that research dehumanizes individuals by reducing them to test measures. Thus, little controlled research has been done to clarify the effectiveness of this approach.

Humanistic and Existential Therapies in Perspective

By recognizing the special challenges of human existence, both humanistic and existential therapists highlight an aspect of psychological life that is typically missing from the other models (Watson, Goldman, & Greenberg, 2011). In addition, the factors that they say are critical to positive functioning—self-acceptance, personal values, personal meaning, and personal choice—certainly seem to be lacking in many people with psychological disorders. Such virtues aside, the broad issues of human fulfillment at the core of these approaches are hard to research. Only recently have properly controlled studies been conducted. These studies, in fact, suggest that the therapies may be beneficial in some cases (Hoffman et al., 2019; Krug, 2019; Schneider & Krug, 2010). This emerging interest in research regarding humanistic and existential therapies may soon lead to clearer insights about these approaches. Positive Psychology 16.2 shows how humanistic and existential psychology share similar understandings of concepts such as well-being and self-actualization with positive psychology.

16.2 Psychology Around Us | Positive Psychology

Instilling Well-Being in Culturally Diverse University Students

A variety of validated interventions targeted at helping students to flourish in academic settings have been developed (Kern, Waters, Adler, & White, 2015; White & Waters, 2015), but they are rarely used in post-secondary institutions. To help change that, Louise Lambert at the Canadian University in Dubai and colleagues from Canada and South Korea (Lambert, Passmore, & Joshanloo, 2019) introduced a 14-week positive psychology intervention happiness program to university students from 39 different nations, all studying in the United Arab Emirates. Positive psychology interventions are empirically validated activities aimed at increasing positive emotions and at facilitating positive thoughts, leading to well-being, and decreasing depressive and anxious symptoms (Weiss, Westerhof, & Bohlmeijer, 2016). Lambert and

colleagues deliberately chose happiness as a variable of well-being in their program. Happiness is not universally viewed as desirable across all cultures and religions. Fear of happiness, the fragility of happiness, or happiness acting as an invitation to future negative consequences exist across many cultures (Joshanloo et al., 2014; Joshanloo, 2013).

Lambert et al.'s study (2019) was aimed at evaluating changes in well-being in a culturally diverse group of students after they completed a one-semester happiness program, Happiness 101, and assessing the program's impact on feelings regarding the fragility of happiness. The Happiness 101 program was based on the PERMA model (Seligman, 2011) that offers five pathways to well-being: Positive emotion, Engagement, Relationships, Meaning, and Accomplishments. Results indicated that students benefited from the program's positive psychological interventions and showed increased *hedonic* (pleasure and enjoyment) and *eudaimonic* (finding meaning and purpose in life) well-being from pre- to post-testing. Increases in well-being were at high levels when measured three months post follow-up. Results also indicated that engaging in the intervention, learning about the science of well-being, and being exposed to positive psychological concepts served to reduce beliefs regarding the fear of happiness and the fragility of happiness. This reduction in fear in turn reduced pessimistic thinking in participants. No significant differences due to religion or faith were observed across participants. The authors indicate that their results argue for the importance of tracking indicators in the well-being of students.

FilippoBacci/E+/Getty Images

Flourishing in post-secondary institutions **Positive psychological interventions can have lasting impacts on student well-being across culturally diverse groups.**

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

14. What are the key characteristics therapists should display in client-centred therapy?

15. What techniques are used in Gestalt therapy?

16. What are the main goals of existential therapy?

What Do You Think? • What kind of clients and what kind of problems do you think would benefit most from humanistic and existential therapies?

Formats of Therapy

LEARNING OBJECTIVE 7

Describe commonly used formats of therapy.

Thus far, our discussions of therapy have centred on treatments conducted by individual therapists with individual clients. In fact, **individual therapy** is the oldest of the modern therapy formats. Other formats, often used as alternatives to individual therapy, include *group therapy,* (Fonagy, Campbell, & Bateman, 2017) *family and couple therapy* (McGoldrick & Hardy, 2019), and *community treatment* (see photos). Therapists may apply their favoured techniques and principles in each of these formats, whether psychodynamic, behavioural, or other techniques. In addition, special strategies have been developed for use in the non-individual formats.

individual therapy psychotherapy format in which the therapist sees the client alone; the oldest of the modern formats.

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monkeybusinessimages/Getty Images

lightfieldstudios/123 RF

Range of formats Individual therapy (left) used to be the only treatment format for psychological problems. Today, other formats are also used, such as group therapy

(middle) and couple therapy (right).

Group Therapy

In **group therapy**, a therapist sees several clients who are grappling with psychological problems at the same time. Group therapy became a popular format for treating people with psychological difficulties after World War II, when growing demand for psychological services forced therapists throughout North America and Europe to look for time-saving alternatives to individual therapy (Fehr, 2014). Many therapists now specialize in group therapy, and others conduct therapy groups as one aspect of their practice.

> **group therapy** psychotherapy format in which a therapist sees several clients at the same time.

Typically, group members meet with a therapist and discuss the problems or concerns of one or more of the members (Burlingame & Baldwin, 2011). Groups are often created with particular client populations in mind. For example, there are groups for people with alcoholism, for people who are physically handicapped, and for people who are divorced, abused, or bereaved.

On the basis of his own work and other investigations, a leading group-therapy theorist, Irvin Yalom, suggests that successful forms of group therapy share certain "curative" features (Yalom & Leszcz, 2014):

> *Guidance* Group therapy usually provides information and advice for members.
>
> *Identification* Group therapy provides models of appropriate behaviour.
>
> *Group cohesiveness* Group therapy offers an atmosphere of solidarity in which members can learn to take risks and accept criticism.
>
> *Universality* Members discover that other people have similar problems.
>
> *Altruism* Members develop feelings of self-worth by helping others.
>
> *Catharsis* Members develop more understanding of themselves and of others and learn to express their feelings.
>
> *Skill building* Members acquire or improve social skills.

One kind of group intervention in wide use today is **self-help groups**. These groups are made up of people who have similar problems or who may be at different places in a life process (e.g., supporting a loved one with Alzheimer's) and come together to help and support one another without the direct leadership of a professional clinician (White & Madara, 2011). Self-help groups have become increasingly popular over the past few decades.

> **self-help groups** groups consisting of people who have similar problems and come together to help and support one another without the direct leadership of a professional clinician.

Self-help groups address a wide assortment of issues. Examples include alcoholism and

other forms of substance abuse, compulsive gambling, bereavement, overeating, phobias, child abuse, medical illnesses, rape victimization, unemployment, and divorce. Online self-help chat rooms and message boards are often similar to traditional self-help groups and have themselves exploded in number and popularity in recent years.

Self-help groups are popular for several reasons. Many participants have lost confidence in the ability of clinicians and social institutions to help with their particular problems. For example, Alcoholics Anonymous, the well-known network of self-help groups for people dependent on alcohol, was developed in 1934 in response to the general ineffectiveness of clinical treatments for alcoholism (Cheever, 2015). Still other people are drawn to self-help groups because they find them less threatening and less stigmatizing than therapy groups.

Because groups—from conventional therapy groups to self-help groups—vary so much, it has been difficult to assess their effectiveness. Research does suggest, however, that group therapy is often of help to clients—perhaps as helpful as individual therapy (Cruwys et al., 2015; Burlingame & Baldwin, 2011). It appears that candid feedback is usually useful for group members as long as a balance is struck between positive and critical feedback (Slone et al., 2015).

Family Therapy

Family therapy dates back to the 1950s. In this format, therapists meet with all members of a family, point out problematic behaviours and interactions between the members, and try to help the whole family change (Goldenberg & Goldenberg, 2011) (see photo). Most family therapists meet with family members as a group, but some choose to see them separately. Either way, the family is viewed as the unit under treatment.

> **family therapy** a format in which therapists meet with all members of a family to help the whole family to change.

PokPak05/iStock/Getty Images Plus

Family therapy In family therapy, the family is treated as a unit, regardless of whether individual family members are counselled or whether the entire family is

counselled together.

Like group therapists, family therapists may follow the principles of any of the major theoretical models. Whatever their orientation, however, most also adhere to some of the principles of family systems theory. Family systems theory holds that each family has its own implicit rules, relationship structure, and communication patterns that shape the behaviour of the individual members, including dysfunctional behaviour. For one family member to change, the family system must change (Gurman & Kniskern, 2014).

Family therapies are often helpful to individuals (Blow & Karam, 2016). Research has not fully clarified how helpful, however (Goldenberg & Goldenberg, 2011). Some studies have found that as many as 65 percent of individuals treated with family approaches improve, but other studies have found much lower success rates. Nor has any one type of family therapy emerged as consistently more helpful than the others (Sexton & Lebow, 2015; Carr, 2014).

Couple Therapy

In **couple therapy**, also known as **relationship counselling**, the therapist works with two people who are in a long-term relationship, focusing on the structure and communication patterns in their relationship (Gurman & Snyder, 2011; Baucom et al., 2010). Often this format of therapy involves a husband and wife, but the couple need not be married or even living together. Similarly, they need not be heterosexual. Indeed, some therapists specialize in working with same-sex couples.

> **couple therapy** or **relationship counselling** therapy format in which a therapist works with two people who are in a long-term relationship.

Although some degree of discord occurs in any long-term relationship, there is growing evidence that many adults in our society experience serious relationship issues. Currently, it is estimated that 38 percent of Canadian marriages do not survive past the thirtieth anniversary and over 41 percent do not survive past fifty years of marriage (Statistics Canada 2020; Saint-Jacques et al., 2016; Milan, 2013). Other cohabitation arrangements show similar patterns of dissolution or separation (Bouchard & Saint-Aubin, 2014).

Like group and family therapy, couple therapy may be conducted using any theoretical techniques or perspectives (Baucom et al., 2010). People treated in couple therapy show greater improvements in their relationships than people who fail to receive such treatment. Some research suggests that no one form of couple therapy stands out as more effective than the others (Gurman & Snyder, 2011; Christensen et al., 2010) but other research suggests that emotion-focused therapy is superior to other approaches for couple therapy (Dalgleish et al., 2015; Johnson & Greenberg, 2013). Two-thirds of treated couples display improved marital functioning. However, fewer than half of those who are treated achieve “distress-free” relationships. One-quarter of all treated couples eventually divorce (Hewison, Casey, & Mwamba, 2016; Petch, Lee, Huntingdon, & Murray, 2014).

Community Treatment

At one time, people with psychological disorders, especially severe disorders, had to seek

help from distant facilities or institutions. Today, however, a number of **community mental health treatment** programs offer such people services from nearby agencies. Community-based treatments include community mental health centres, community day programs, and group homes and other residential services. Collectively, these agencies often play a major role in the treatment of people with severe psychological disorders, such as schizophrenia (Daly, Doherty, & Walsh, 2010) (see photo).

community mental health treatment treatment programs that emphasize community care, including an emphasis on prevention.

M. Spencer Green/AP

Community mental health in action **This man diagnosed with both schizophrenia and bipolar disorder is moving into his own apartment, a key step in his recovery.**

A key feature of community treatment is *prevention*. Community clinicians reach out to clients rather than wait for them, an approach that is often very successful (Conyne & Harpine, 2010; Juhnke, Granello, & Granello, 2011). Community workers identify three types of prevention: *primary*, *secondary*, and *tertiary*.

Primary prevention consists of efforts to improve community functioning and policies. The goal of primary prevention is to prevent psychological disorders altogether. Community workers may lobby for better child-care facilities in the community, consult with a district school board to help develop a curriculum, offer mental health fairs or workshops on stress reduction, or provide online information and support sites.

Secondary prevention consists of detecting and treating psychological disorders in the early stages, before they reach serious levels. At the secondary prevention level, community workers may teach clergy, teachers, or police how to identify early signs of psychological dysfunction and how to refer people for treatment.

Tertiary prevention aims to provide effective treatment immediately so that moderate or severe disorders do not become chronic problems. Unfortunately, although

community agencies are able to offer tertiary care for millions of people with moderate problems, low funding often prevents them from providing care for many of the other hundreds of thousands with severe disorders (Althouse, 2010). See Psychology Around Us 16.2 for more information on community care.

16.2 Psychology Around Us

In Need of Comprehensive Community Care

What happens to people with severe psychological disorders whose communities do not provide the mental health services they need and whose families cannot afford private treatment? Many depend on their families and receive medication and support, but little else in the way of treatment (Bucci, Berry, Barrowclough, & Haddock, 2016). Approximately 8 percent receive only custodial care and medication in an alternative institution, such as a nursing home or rest home. As many as 18 percent are placed in privately run residences, such as boarding houses, where supervision often is provided by untrained individuals. Another 31 percent live in totally unsupervised settings, including rundown single-room-occupancy hotels or rooming houses, surviving on government disability payments, and spending their days without purpose (Burns & Drake, 2011). Many become homeless (Kooyman & Walsh, 2011), and many more end up in prisons (Scott, 2010).

With these statistics in mind, Anita Palepu, from the University of British Columbia, and her colleagues investigated the effects of concurrent disorders (defined as co-occurring mental health and substance-related disorders) and health care use in homeless and vulnerably housed single adults from Vancouver, Toronto, and Ottawa over a four-year period (Zhang et al., 2018). In their sample, 44 percent of participants who reported mental health issues also reported substance abuse issues. Individuals with concurrent disorders were more likely to be younger, to be female, to have three or more chronic health issues, and to have a history of incarceration in the previous year. Three out of five participants with concurrent disorders reported polysubstance use, defined as using three or more substances. The study findings indicated that concurrent disorders, homelessness, chronic health conditions, and a history of incarceration were significant predictors of emergency department (acute care) use. Moreover, the level of acute care and primary care utilization was significantly higher among those with concurrent disorders than among those without concurrent disorders. This data supports previous findings indicating that primary care services are unable to effectively manage mental health symptoms and substance use in homeless and vulnerably housed individuals, underscoring the need for more comprehensive programs for such people with mental health and/or substance use disorders.

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

17. What are self-help groups?

18. What is the main assumption of family systems therapy?

19. Describe primary, secondary, and tertiary prevention.

What Do You Think? Which therapy format appeals to you most? Least? Why? Are certain formats better suited for particular problems or client personalities?

Does Therapy Work?

LEARNING OBJECTIVE 8

Summarize research on the effectiveness of therapy.

As we noted earlier, as many as 400 forms of therapy are currently practised in North America (Corsini & Wedding, 2011). The most important question to ask about each of them is whether the therapy really helps. **Therapy outcome studies**, which measure the effects of various treatments, typically ask one of four questions:

Is therapy in general effective? Studies reveal that therapy is often more helpful than no treatment or placebo treatments. Using a statistical technique called *meta-analysis* in which the results from a large number of studies are combined to provide a more general picture of a particular area of interest, a variety of studies indicate that psychotherapy across a wide range of disorders is more effective than no treatment at all, for the majority of clients (Swift, Spencer, & Goode, 2018; Campbell et al., 2013; Cuijpers, Berking et al., 2013; Sharf, 2012). However, psychotherapy does not work for everyone, with some clients reporting that they experienced the therapeutic process as distant or artificial or as overly focused on the past (Werbart, Von Below, Brun, & Gunnarsdottir, 2015). Approaches unique to Indigeous people are discussed in Indigenous Experiences 16.2.

How effective are particular therapies? A number of studies have found that each of the major forms of therapy is of some help to clients—certainly of more help than a placebo treatment (Shean, 2016; Huhn et al., 2014; Prochaska & Norcross, 2010; Overholser, Braden, & Fisher, 2010). Other research has compared these major forms of therapy to one another and found that no one form of therapy generally stands out over all others (Miller, Hubble, Chow & Seidel, 2013). Research suggests that different kinds of therapy have similar overall success rates because they share common features such as effectiveness of the therapist, strength of the therapeutic alliance, and the client's role as an active contributor (Owen, Drinane, Idigo, & Valentine, 2015; Sharf, 2012; Bohart & Tallman, 2010). Surveys of highly successful therapists suggest that, regardless of their particular orientations, successful therapists tend to do similar things: (1) they provide feedback to clients; (2) they help clients focus on their own thoughts and behaviour; (3) they pay careful attention to the way they and their clients interact; and (4) they try to build a sense of self-mastery in their clients

(Jennings et al., 2016).

Are particular therapies especially effective for certain problems? Researchers have found that particular therapies are especially effective at treating specific types of disorders (Beutler, 2011; Corsini & Wedding, 2011). Behavioural therapies, for example, seem to be the most effective of all treatments for phobias (Waters, Bradley, & Mogg, 2014; Wilson, 2011). Cognitive-behavioural therapies are particularly helpful in cases of social anxiety disorder, generalized anxiety disorder, panic disorder, and depression (Hudson et al., 2015; Cuijpers, Sijbrandij, et al., 2013; Craske, 2010; Pontoski et al., 2010). And drug therapy is the single most helpful treatment for schizophrenia and bipolar disorder (Minzenberg, Yoon, & Carter, 2011). Today's clinicians may also combine two or more approaches when treating particular disorders (Cuijpers et al., 2010). Drug therapy, for example, is often combined with cognitive-behavioural therapy to treat depression or various anxiety disorders, although the superiority of such combinations over the individual approaches has not been supported consistently by research (Otto, McHugh, & Kantak, 2010; Pontoski & Heimberg, 2010). In fact, it is now common for clients to be seen by two therapists—one of them a physician or psychiatrist who prescribes medication and the other a psychologist, social worker, or other therapist who conducts psychotherapy.

Is therapy equally effective across race and gender? Studies conducted in countries across the world have found that members of ethnic and racial minority groups typically show less improvement in clinical treatment, make less use of mental health services, and stop therapy sooner than members of majority groups (Comas-Diaz, 2011; Benish, Quintana, Wampold, 2011). Given such findings, a number of clinicians have developed **culture-sensitive therapies**, which seek to address the unique issues faced by members of cultural minority groups. Clinicians using these approaches typically try to do the following (Brown, 2011; Comas-Diaz, 2011):

- Be aware of the client's cultural values.
- Be aware of the stress, prejudices, and stereotypes to which minority clients are exposed.
- Be aware of the hardships faced by the children of immigrants.
- Help clients recognize the impact of both their own culture and the dominant culture on their self-views and behaviours.
- Help clients identify and express suppressed anger and pain.
- Help clients achieve a bicultural balance that feels right for them.
- Help clients raise their self-esteem—a sense of self-worth that has often been damaged by generations of negative messages.

therapy outcome studies research that looks at the effects of various treatments.

culture-sensitive therapies approaches that seek to address the unique issues faced by members of cultural minority groups.

16.2 Indigenous Experiences

Healing Journey

Worldviews reflect deeply held values as well as fundamental beliefs about how the world operates, why things happen as they do, and what an individual's purpose is, and they therefore encompass how the world is experienced and understood. The Indigenous worldview includes concepts of holistic and spiritual understanding, a belief in many truths, connection to land, a view of time as nonlinear, and the importance of balance and of relationships with family and community (Castellano, 2006b). It is therefore crucial that effective healing programs for Indigenous people reflect this worldview.

Marlene Brant Castellano a Mohawk, now retired from Trent University, led a team that produced a three-volume report for the Aboriginal Healing Foundation examining the journey to wellness and promising healing practices for addressing the legacy of abuses from the residential school system (2006a; 2006b). Part of the report focused on culturally appropriate ways to address trauma and recovery. Addressing belief systems based on balance, connection, harmony, and growth and recognizing the critical role of identifying with family, ancestors, and community as central to the healing journey for many Indigenous people (2006b). "Principles of 'good' therapy are generally compatible with Aboriginal values, but they tend not to be Aboriginal-specific" (Castellano, 2006a, p. 120).

Based on "lessons from the field, especially the grassroot wisdom of community healing teams who work with these issues everyday" (Castellano, 2006a, p. 121), Castellano and colleagues developed a Framework for Understanding Trauma and Healing Related to Residential School Abuse for developing successful programs with survivors. The framework includes three necessary elements: Indigenous values and worldview, personal cultural safety, and capacity to heal. Further, the framework rests on three pillars of healing: Reclaiming history, cultural interventions, and therapeutic healing. Situated below the three pillars are factors unique to a person such as personal, family, and community history.

Examples of two effective programs cited in the report (Castellano, 2006a) are:

> **Qu'Appelle Child and Family Services (QCFS), Fort Qu'Appelle, Saskatchewan:** QCFS Elders and traditional resource people work with project field staff and residential school survivors from the Muscowpetung, Nekaneet, Pasqua, Piapot, Standing Buffalo, and Wood Mountains First Nations on topics such as "self-esteem, grief, loss, denial, anxiety, guilt and memory" (p. 175). Elders are involved in every aspect of the program and speak in their own language (Dakota, Lakota, Nakota, Ojibway, and Cree); staff speak in English and a project coordinator puts English words into First Nations concepts.
>
> **Centre for Indigenous Sovereignty, *I da wa da di*, Six Nations, Ontario:** I da wa da di (We Should All Speak) offers retreats and workshops open to all Indigenous women in Ontario and also offers training for others who work with survivors. The program blends cultural and traditional elements in an atmosphere described

as "holistically safe, caring, and nonjudgmental" (p. 177). Participants ascribe feelings of safety to factors such as the opportunity to be with Elders, cultural aspects of the program, including traditional teaching, certainty around confidentiality, support from others, and "the presence of love, nurturing and laughter" (p. 177). Program activities are frequently facilitated by past participants, themselves survivors of residential schools and intergenerational trauma.

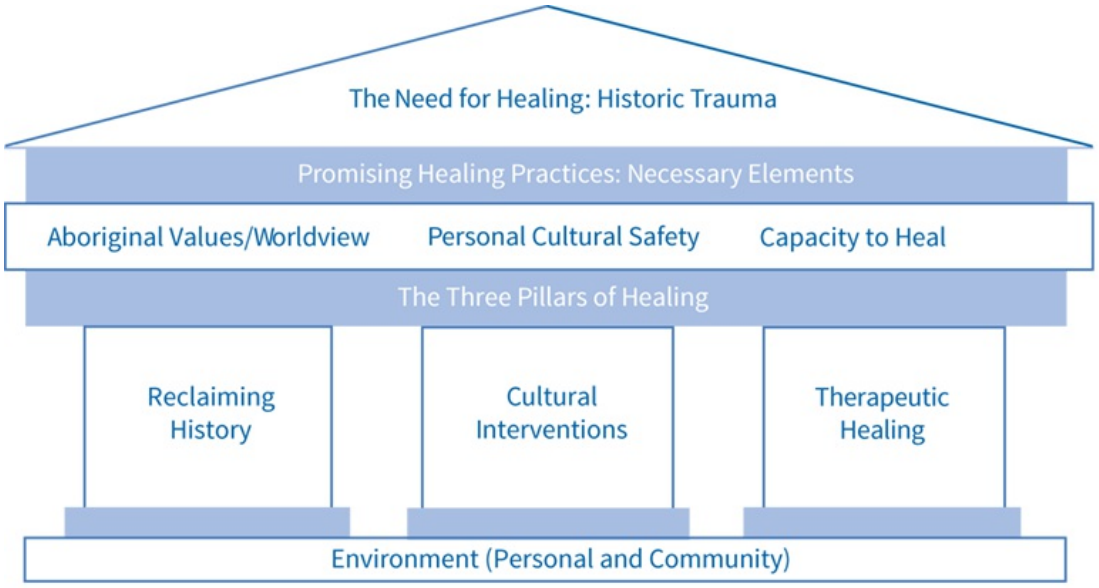
Many other programs are also highlighted in the report, but all share the common features of "two-eyed seeing" as first identified by Mi'kmaw elders Albert Marshall and Murdena Marshall (Marsh et al., 2015; Bartlett et al., 2012; Castellano, 2006b).

The Framework for Understanding Trauma and Healing Related to Residential School Abuse is based on historic trauma theory. It is composed of program elements necessary for supporting the healing process and intervention strategies, the three pillars of healing, necessary for implementing healing processes. In their personal and collective journey, participants can move among the intervention strategies singly or in concert. Below the three pillars of healing are the factors unique to a given individual.

Critical Thinking Questions

Identify culturally appropriate ways that each of the two effective programs identified here address trauma and recovery.

Based on all you have learned about Indigenous experiences, why do you think that Reclaiming History is one of the Three Pillars of Healing in this model?



Source: Marlene Brant Castellano 2006, Final Report of the Aboriginal Healing Foundation A Healing Journey: Reclaiming Wellness, Volume I.

Therapies geared to the pressures of being female, called **gender-sensitive**—or **feminist**

—therapies, follow similar principles (Calogero, Tantleff-Dunn, & Thompson, 2011). In a related vein, when working with clients with spiritual beliefs, many of today's therapists make a point of including spiritual issues in therapy (Aten, McMinn, & Worthington, 2011; Worthington, 2011). These therapists may, for example, encourage clients to use their spiritual resources to help them cope (Galanter, 2010a, 2010b).

> **gender-sensitive** or **feminist therapies** approaches that seek to address the unique pressures of being female.

Obviously, knowledge of how effective particular therapies are for particular disorders and particular populations helps therapists and clients alike to make better decisions about treatment (Beutler, 2011; Beutler et al., 2013) (see Practically Speaking 16.1). To help clinicians become more familiar with and apply such research findings, there is a movement in Canada, the United States, the United Kingdom, and elsewhere called the **empirically supported** or **evidence-based treatment movement** (Norcross & Lambert, 2019; Laska et al., 2014; Sharf, 2012; Pope & Wedding, 2011. This empirically supported treatment movement has been gaining momentum in recent years. Proponents of this movement have formed task forces that seek to identify which therapies have received clear research support for particular disorders, to propose corresponding treatment guidelines, and to share this information with clinicians. Critics of the movement suggest that such efforts are at times simplistic, biased, and even misleading and might benefit from integration with other approaches (Laska et al., 2014).

> **empirically supported** or **evidence-based treatment movement** movement to help clinicians become more familiar with and apply research findings concerning the effectiveness of particular treatments.

Another movement that has been receiving support in recent years is a move toward integration and eclecticism among psychotherapeutic approaches. This move supports the integration of a variety of psychotherapeutic perspectives rather than adherence to a particular orientation. This movement encourages practitioners to integrate diverse approaches and to draw on a variety of perspectives when treating clients. (See the Society for the Exploration of Psychotherapy Integration for more information on this topic.)

16.1 Practically Speaking

How Do I Find and Choose a Therapist?

Selecting the right therapist is obviously a very important decision. Even if you seek assistance at the student wellness or counselling centre at your college or university (where treatment is usually free to students) or if you seek a referral to a therapist from your family doctor, a friend or relatives, or your province's College of Psychologists, you still have some choice regarding which of the available therapists you can work with.

wavebreakmedia/Shutterstock.com

Here is a list of key questions to consider when selecting a therapist. You should direct some of the questions to the potential therapists themselves.

Where can you get names of skilled potential therapists? Ask a professional whom you trust—a psychologist you know, such as your introductory psychology professor, someone at your local student wellness or counselling centre, a family physician, or look on the Internet—for recommendations. Many provinces or cities also provide relevant information and lists.

What is the professional status of the potential therapists? Are they clinical psychologists, psychiatrists, social workers, or counsellors? Are they chartered/registered with your province's regulatory college for their profession?

What is the experience level of the potential therapists? What is their overall experience in the field? What is their specific experience and success rate with your kind of problem?

What is the treatment orientation of the potential therapists? Are they psychodynamic, behavioural, cognitive, humanistic, existential, or eclectic? How do they approach problems such as yours? Does this approach feel like a reasonable fit for you?

What is the success rate of their treatment orientation for problems such as yours? Reading this chapter or an abnormal psychology textbook should help you with this question.

Do the potential therapists believe in psychotropic medication as part of therapy in certain cases? Can they arrange for medication consults with a physician or a psychiatrist if needed?

How do the potential therapists match up on personal variables that are important to you? Access feedback from previous clients. What are their genders, ages, personalities, and the like? Although such factors do not necessarily affect a therapist's ability to help, you may personally feel that the variables could affect your comfort level or confidence in the therapy process.

Once you are in therapy, are you comfortable with the way things are going? Does the therapist seem attentive, interested, and engaged? Does the therapist's approach continue to make sense to you? Do you feel you are making progress? Don't be afraid to change therapists if, after a reasonable period of time, you are not making progress. In most such instances, you are not failing at therapy. The therapy is failing you!

Before You Go On

(Answers to Before You Go On may be found online in the Course Resources.)

What Do You Know?

20. What does research show about whether or not therapy is generally effective?

21. What do effective therapists have in common?

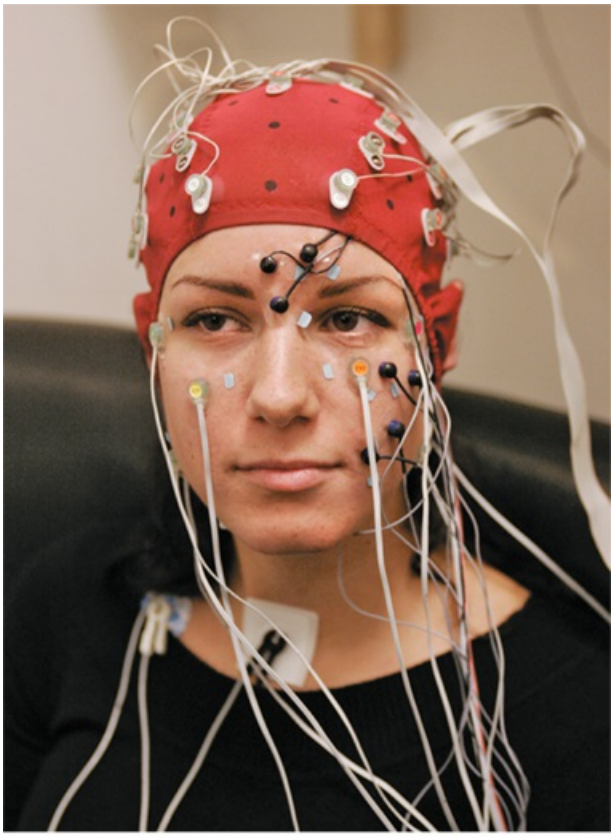
22. What does research show about the effectiveness of particular therapies for certain problems?

23. Is therapy equally effective across race and gender?

What Do You Think? • If a person feels that her treatment is not helping, is it likely worthwhile for that person to try to change therapists or treatment methods? Why or why not?

Some Final Thoughts About the Field of Psychology

It is ironic that we end this book with chapters on abnormal psychology and its treatments. Early on, we noted that many people automatically think of abnormal psychology when they hear the term *psychology*. But, as you have seen throughout this book, psychology is a broad field that studies all kinds of mental processes and behaviour. And, as you have also observed, all of those processes and behaviours—both normal and abnormal—are rather awe-inspiring. For example, disorders of memory, such as Alzheimer's disease and dissociative identity disorder, are certainly fascinating. But normal acts of memory—our very ability to encode, store, and retrieve so many experiences and pieces of information in the first place—are no less remarkable.



Chuck Stoody/AP

Covering all the angles To fully understand a mental process such as "intruding thoughts," today's psychologists study the phenomenon at many levels, from measuring the brain waves of individuals while their minds wander (seen here), to determining the possible childhood roots of such thoughts.

Psychology is a wide-ranging and complex field consisting of many sub-areas, from sensation and perception to social psychology. Each seeks to explain particular aspects of mental functioning from a particular angle. Collectively, these many sub-areas provide us with an impressive understanding of mental processes and behaviour. But it is important to recognize that this understanding is at a very early stage of development. There are many miles to go in our quest to more fully understand the subject matter of psychology.

Perhaps the most important feature of psychological study today—and one that offers enormous promise for the future—is that the sub-areas are coming together. More and more, they are being viewed as closely connected areas of study. Each helps to inform the others, and all can, collectively, provide a more integrated, complete, and accurate understanding of mental processes and behaviour (see photo). It is, for example, no longer a matter of choosing between neuroscience, cognitive psychology, and social psychology to understand how and why people behave (or don't behave) when passing by an accident scene. Rather, we seek to understand how these interacting subfields jointly account for that behaviour. In short, psychology is becoming a truly integrated field. Given this critical course correction, one can only imagine how many insights and breakthroughs regarding mental processes and behaviour lie ahead.

Summary

Treatment in Today's World

LEARNING OBJECTIVE 1 Explain who receives treatment for psychological problems today, how they enter treatment, and what general features characterize different types of treatment.

More than 20 million North Americans receive therapy for psychological problems in the course of a year. Almost half suffer from anxiety and depression.

Therapy was once primarily a privilege of the wealthy, but today people at all socio-economic levels receive treatment. Similarly, while women once outnumbered men in therapy by four to one, men today are more willing to enter therapy than before.

People may enter therapy on their own or may be forced into treatment. Many never seek treatment at all.

A variety of professionals conduct therapy, including psychologists, psychiatrists, counsellors, and psychiatric social workers.

Most clients are treated in the community as out-patients, but some people with severe problems are treated as in-patients in private or public institutions.

All forms of therapy have three essential features: a sufferer who seeks relief, a trained healer, and a series of contacts between the two in which the healer tries to bring about changes in the sufferer's emotional state, attitudes, and behaviour.

Biological Treatments

LEARNING OBJECTIVE 2 Describe the major biological treatments for psychological disorders.

Drug therapy, *electroconvulsive therapy (ECT)*, and *psychosurgery* are the three major categories of biological treatments.

Psychotropic drugs, including *antianxiety, antidepressant*, and *antipsychotic drugs*, have brought relief to many, but they do not work for everyone and may have undesired side effects.

Electroconvulsive therapy (ECT), used primarily to treat depression, is administered less often today than in the past. Two more recently developed brain stimulation treatments, *vagus nerve stimulation* and *transcranial magnetic stimulation*, have fewer wide-ranging and traumatic side effects than ECT.

Psychosurgery today is much more precise than the lobotomies of the past, in which the connections between the frontal lobe and the lower brain centres were severed.

Biological treatments for psychological disorders, particularly drug treatments, are highly regarded today. However, more often than not, biological interventions alone are not enough.

Psychodynamic Therapies

LEARNING OBJECTIVE 3 Describe the psychodynamic treatments for psychological disorders.

Psychodynamic therapies range from classical *Freudian psychoanalysis* to modern therapies. All share the goals of helping clients to uncover past traumatic events and the inner conflicts that have resulted from them, and to resolve those conflicts.

Psychodynamic therapy techniques include *free association*; therapist interpretation of *resistance*, *transference*, and *dreams*; *catharsis*; and repeatedly *working through* issues.

Recent developments in psychodynamic therapy include *short-term psychodynamic therapy* and *relational psychoanalytic therapy*.

The psychodynamic approach has had a lasting influence on the conduct of treatment and was the first to offer an alternative to biological explanations of abnormal functioning. But the effectiveness of psychodynamic therapy is not well supported by research.

Behavioural Therapies

LEARNING OBJECTIVE 4 Describe the behavioural treatments for psychological disorders.

Behavioural treatments, aimed at replacing abnormal behaviours with more functional ones, are based on learning processes. Behavioural techniques fall into three categories: *classical conditioning*, *operant conditioning*, and *modelling*.

Systematic desensitization and *aversion therapy* rely on classical conditioning. Systematic desensitization is especially effective in treating phobias, while aversion therapy has been used to treat people who want to eliminate problem behaviours, such as drinking.

Token economies follow the principles of operant conditioning and use rewards to encourage desired behaviours.

Social-skills training uses modelling to help clients acquire desired social behaviours.

Research suggests that behavioural therapies are often effective. They do not always bring lasting change outside therapy, however, and do not appear particularly effective with disorders that are broad or vaguely defined.

Cognitive-Behavioural Therapies

LEARNING OBJECTIVE 5 Describe cognitive-behavioural therapies for psychological disorders.

Cognitive-behavioural therapists try to help people recognize and change their faulty thinking processes. Most such therapies use some behavioural techniques. Three influential cognitive-behavioural approaches are those of *Albert Ellis*, *Aaron Beck*, and the "*second-wave*" *cognitive-behavioural therapists*.

Ellis's *rational-emotive behavioural therapy* focuses on helping clients to identify their maladaptive assumptions, test them, and change them.

Beck's cognitive therapy guides clients to challenge their maladaptive attitudes,

automatic thoughts, and illogical thinking. Research supports the effectiveness of cognitive therapy for depression and certain other disorders.

Second-wave cognitive-behavioural therapies help clients to accept their problem behaviours rather than judge them, act on them, or try fruitlessly to change them.

The cognitive view is quite popular today, and research suggests that cognitive treatment is often effective. It is still not clear, however, whether psychological disorders create or result from maladaptive thoughts.

Humanistic and Existential Therapies

LEARNING OBJECTIVE 6 Describe the humanistic and existential therapies for psychological disorders.

Humanistic and existential therapists try to help clients look at themselves and their situations more accurately and acceptingly.

Therapists practising Carl Rogers's *client-centred therapy* try to provide *unconditional positive regard*, *accurate empathy*, and *genuineness*, so that clients come to value their own emotions, thoughts, and behaviours.

Gestalt therapists use skillful frustration, role playing, and rules to help clients recognize and accept their needs and goals.

Existentialist therapies focus on helping clients discover their personal freedom of choice and take responsibility for making choices.

Only recently have humanistic and existential therapies begun to undergo systematic research. Early research suggests they can be beneficial for some clients.

Formats of Therapy

LEARNING OBJECTIVE 7 Describe commonly used formats of therapy.

Individual therapy, in which practitioners meet with one client at a time, is the oldest of the modern therapy formats.

In *group therapy*, several clients with similar problems meet with a single therapist at the same time. *Self-help groups* are similar, but conducted without the leadership of a therapist. Both types of groups can be helpful for certain clients.

Family therapy treats all members of a family, together or individually, and therapists usually consider the family as a system.

Two people in a long-term relationship can seek *couple therapy* to help address issues in their relationship.

Community mental health treatment focuses on preventing abnormal functioning through: (1) primary prevention—policies that reduce psychological risk in a community; (2) secondary prevention—treating minor problems before they become serious; and (3) tertiary prevention—providing prompt treatment for moderate and severe disorders so they do not become long-term problems.

Does Therapy Work?

LEARNING OBJECTIVE 8 Summarize research on the effectiveness of therapy.

In general, receiving therapy is more likely to help people with psychological disorders than going without treatment. Research has found that each of the major forms of therapy is of some help to clients, although research also indicates that particular therapies are often best suited for certain disorders.

Successful therapists often share similar effective elements in their approaches, regardless of their particular orientations. They provide feedback, help clients focus on their own thoughts and behaviour, pay careful attention to the way they interact with clients, and try to build a sense of self-mastery in their clients.

Women and members of ethnic minority groups face pressures that sometimes contribute to psychological dysfunctioning. *Culture-sensitive* and *gender-sensitive therapy* approaches help clients become aware of and react adaptively to the gender-related and cultural pressures and issues they face.

The *empirically supported* or *evidence-based treatment movement* seeks to identify which therapies have received clear research support for particular disorders, to propose corresponding treatment guidelines, and to spread such information to clinicians.

Key Terms

antianxiety drugs

antidepressant drugs

antipsychotic drugs

aversion therapy

biological therapy

catharsis

client-centred therapy

cognitive therapy

community mental health treatment

couple therapy or relationship counselling

culture-sensitive therapies

deep brain stimulation

electroconvulsive therapy (ECT)

empirically supported or evidence-based treatment movement

family therapy

free association

gender-sensitive or feminist therapies

group therapy

individual therapy

lobotomy

mood stabilizing drugs

placebo

psychosurgery

psychotherapy

psychotropic drugs

rational-emotive behavioural therapy

relational psychoanalytic therapy

resistance

self-help groups

social skills training

therapy outcome studies

token economy

transcranial magnetic stimulation (TMS)

transference

treatment or therapy

trephining

vagus nerve stimulation

Self-Study Questions

Multiple Choice

1. The most common psychological problems that lead people in Canada to seek treatment are

- **a.** anxiety and depression.
- **b.** bipolar disorder and schizophrenia.
- **c.** dissociative disorder and depression.
- **d.** schizophrenia and anxiety.

2. The most commonly used biological treatment for psychological disorders is

- **a.** deep brain stimulation.

b. drug therapy.

c. electroconvulsive therapy.

d. psychosurgery.

3. A client in therapy is asked to describe thoughts as they come to mind. What therapeutic technique does this describe?

a. Free association

b. Resistance

c. Transference

d. Working through

4. The behavioural therapy of systematic desensitization works primarily through the principle of

a. extinction.

b. negative reinforcement.

c. positive reinforcement.

d. punishment.

5. When therapists demonstrate appropriate behaviour to clients and then ask the clients to imitate and rehearse it, this is called

a. a token economy.

b. classical conditioning.

c. modelling.

d. social skills training.

6. Which of the following theorists would be most likely to give clients homework assignments requiring them to observe and challenge their assumptions?

a. Beck

b. Ellis

c. Perls

d. Rogers

7. Which statement about the cognitive-behavioural approach to therapy is false?

a. It has been found to be highly effective.

b. It is difficult to determine whether irrational thoughts are a cause or an effect of maladaptive behaviour.

c. It is only applicable to the treatment of depression and has limited use for other conditions.

d. Research has consistently found that there is a link between maladaptive thoughts and maladaptive behaviour.

8. The Gestalt approach to therapy was developed by

a. Abraham Maslow.

b. Albert Ellis.

c. Carl Rogers.

d. Fritz Perls.

9. A school district launching a smoking awareness program to try to reduce the number of students who start smoking is an example of _____ prevention.

a. educational

b. primary

c. secondary

d. tertiary

10. Research shows that effective therapists tend to do all of the following except

a. encourage clients to focus on their own thoughts and behaviour.

b. pay attention to the interactions between therapist and client.

c. provide feedback to clients.

d. use psychodynamic techniques such as free association and dream analysis.

Fill-in-the-Blank

1. Most people seeking mental health services receive _____ treatment, whereby clients visit a therapist's office, but live in the community.

2. Recent research shows that electroconvulsive therapy (ECT) helps about _____ percent of depressed patients who try it.

3. One downside of _____ medications used to treat disorders such as schizophrenia is that they can cause severe shaking and contractions of the face and body.

4. In psychodynamic therapy, dream interpretation involves examining both the _____ content (the consciously remembered details) and the _____ content (the symbolic meaning of those details).

5. Despite limited evidence of its effectiveness, the psychodynamic approach to therapy is practised by about _____ percent of clinical psychologists.

6. Pointing out the social deficits of clients, then role playing more effective strategies in imaginary social situations, is an approach used in _____ training.

7. Beck's approach to cognitive therapy is most commonly used to treat _____.

8. In contrast to psychodynamic therapy approaches, humanistic and existential therapies usually emphasize _____ experiences rather than conflicts from childhood.

9. One reason why group therapies are helpful is because they encourage group _____, or a sense of unity among group members.

10. Although all forms of therapy tend to help people, some approaches are better suited to particular problems than others. Phobias, for example, are most effectively treated with _____ therapy.

APPENDIX A
Answers to Self-Study Questions

Chapter 1

Multiple Choice 1d, 2d, 3c, 4c, 5a, 6c, 7c, 8c, 9a, 10a. **Fill-in-the-Blank** 1. behaviour 2. control 3. myths 4. functionalists 5. perception 6. punishment 7. self-actualization 8. evolutionary psychology 9. clinical or counselling 10. positive

Chapter 2

Multiple Choice 1a, 2d, 3d, 4b, 5c, 6b, 7c, 8a, 9a, 10b. **Fill-in-the-Blank** 1. cause and effect 2. theories 3. biology 4. eugenics 5. sample 6. survey 7. statistics 8. inferential 9. institutional review board 10. confidentiality

Chapter 3

Multiple Choice 1c, 2b, 3a, 4b, 5d, 6c, 7a, 8a, 9b, 10d. **Fill-in-the-Blank** 1. glial 2. dendrites 3. ependymal 4. all-or-none 5. somatic 6. auditory 7. epilepsy 8. left 9. neural networks 10. acetylcholine (Ach)

Chapter 4

Multiple Choice 1a, 2d, 3b, 4c, 5b, 6a, 7b, 8b, 9b, 10b. **Fill-in-the-Blank** 1. qualitative 2. longitudinal 3. homozygous 4. pruning 5. object permanence 6. concrete operational 7. relationships or care 8. pituitary 9. 30s 10. behaviours

Chapter 5

Multiple Choice 1b, 2d, 3a, 4a, 5c, 6a, 7c, 8d, 9a, 10b. **Fill-in-the-Blank** 1. somatosensory or tactile (touch, heat, pain) 2. transduction 3. papillae 4. hippocampus 5. opposite/contralaterally 6. endogenous opiates 7. amplitude 8. synesthesia 9. pupil 10. temporal/parietal

Chapter 6

Multiple Choice 1b, 2d, 3a, 4d, 5c, 6d, 7b, 8c, 9d, 10b. **Fill-in-the-Blank** 1. blindsight 2. implicit 3. negative 4. manifest 5. circadian 6. sleepwalking 7. tolerance 8. dopamine 9. cocaine 10. cortex, thalamus and hypothalamus, and reticular formation

Chapter 7

Multiple Choice 1c, 2b, 3a, 4b, 5d, 6a, 7d, 8b, 9a, 10b. **Fill-in-the-Blank** 1. learning 2.

neutral 3. primary 4. shaping 5. observational learning 6. episodic/semantic 7. specific learning disorder 8. associative 9. process/remember 10. associative/classical

Chapter 8

Multiple Choice 1b, 2a, 3d, 4d, 5b, 6c, 7b, 8b, 9b, 10a. **Fill-in-the-Blank** 1. sensory memory 2. connectionist or parallel distributed-processing (PDP) 3. rehearsal 4. semantic 5. cue 6. proactive/retroactive 7. hippocampus 8. infantile 9. prospective 10. estrogen

Chapter 9

Multiple Choice 1a, 2d, 3b, 4a, 5a, 6b, 7a, 8a, 9c, 10b. **Fill-in-the-Blank** 1. generative 2. overregularization 3. aphasia 4. Broca's 5. internal 6. crosscultural 7. algorithm 8. availability 9. source 10. Theory of Mind

Chapter 10

Multiple Choice 1a, 2b, 3d, 4c, 5c, 6b, 7d, 8d, 9a, 10d. **Fill-in-the-Blank** 1. theory of multiple intelligences 2. practical 3. bell curve 4. mental age 5. stereotype threat 6. heritable 7. quality 8. frontal 9. cortex 10. home environment

Chapter 11

Multiple Choice 1a, 2d, 3a, 4b, 5d, 6a, 7d, 8b, 9d, 10b. **Fill-in-the-Blank** 1. low 2. incentive 3. dopamine 4. leptin 5. refractory 6. anterior cingulate cortex 7. intrinsic 8. physiological 9. Cannon-Bard 10. efference

Chapter 12

Multiple Choice 1c, 2c, 3b, 4d, 5c, 6c, 7d, 8a, 9a, 10a. **Fill-in-the-Blank** 1. ego/id 2. phallic 3. unconditional positive regard 4. neuroticism 5. situationist 6. phrenology 7. amygdala 8. social role 9. antisocial 10. validity

Chapter 13

Multiple Choice 1b, 2a, 3a, 4c, 5d, 6a, 7c, 8a, 9c, 10b. **Fill-in-the-Blank** 1. justification 2. specificity 3. dispositional 4. collectivism 5. four 6. punishment 7. arousal 8. responsibility 9. prefrontal 10. secure

Chapter 14

Multiple Choice 1d, 2c, 3b, 4c, 5d, 6b, 7b, 8d, 9c, 10b, 11b. **Fill-in-the-Blank** 1. appraising 2. micro (or daily hassle) 3. life-change units 4. stereotype 5. elevated 6. perception 7. avoidance-avoidance 8. Mindfulness 9. HPA (or hypothalamic-pituitary-adrenal) 10 hostility 11. norepinephrine

Chapter 15

Multiple Choice 1a, 2a, 3d, 4c, 5c, 6d, 7c, 8c, 9a, 10b. **Fill-in-the-Blank** 1. deviance 2. comorbidity 3. Bandura 4. multifinality 5. cyclothymic 6. anxiety 7. acute stress 8. positive 9. identical/fraternal 10. frontal

Chapter 16

Multiple Choice 1a, 2b, 3a, 4a, 5c, 6b, 7c, 8d, 9b, 10d. **Fill-in-the-Blank** 1. outpatient 2. 70 3. antipsychotic 4. manifest/latent 5. 15 6. social skills 7. depression 8. present or recent or current 9. cohesiveness 10. behaviour or behavioural

APPENDIX B
Statistics in Psychology

As outlined in Chapter 2, psychology is considered to be a science, given that it relies upon empirical observations of mental processes and behaviour in order to develop and test theories regarding the underlying laws that govern behaviour. Psychologists use statistics to help them summarize and interpret the observations (or data) that they collect in their research. Essentially there are two basic types of statistics used by psychologists: **descriptive statistics**, which include a variety of procedures used to describe and summarize the data collected, and **inferential statistics**, which are procedures that allow psychologists to draw conclusions about the data they have collected. This appendix is designed to help you better understand statistics and how psychologists use them.

descriptive statistics statistics used to describe and summarize data.

inferential statistics statistics used to draw conclusions about research data.

Descriptive Statistics

Statistics are commonly used in psychology to summarize data that have been collected as part of some research project or study. Such statistical summaries are referred to as descriptive statistics.

To illustrate some common descriptive techniques, consider the following data set:

46	56	50	50	59	44
61	49	50	52	32	43
67	58	51	36	58	46
51	54	53	62	50	39
42	44	51	41	53	57

Assume that the data represent scores obtained from 30 students who have taken their first test in an introductory psychology course.

If the instructor is interested in determining how well the students performed on this test, she might quickly eyeball the scores above. However, nothing may readily jump out at her in terms of things like how well the typical student is doing, what was the lowest score, what was the highest score, and so on.

One of the first things the instructor might want to do to get an idea of what's going on with student performance is to simply sort the data so that the scores are arranged from lowest to highest. Doing so produces a data set like the one in **Table B.1**. Now the instructor can look at the data set to see things like the lowest score earned by a student was 32, a fairly large number of students received scores of 50 and 51, and the highest score earned by a student was 67.

TABLE B.1					
Thirty Exam Scores—Sorted					
32	36	39	41	42	43
44	44	46	46	49	50
50	50	50	51	51	51
52	53	53	54	56	57
58	58	59	61	62	67

However, this still doesn't tell her a whole lot about her students' performance. To get a better idea of what's going on in this set of data, the instructor might use a number of descriptive techniques to summarize the data (this would especially be the case if there were a larger number of students in the class, such as 500). One common way to summarize such a data set is to create frequency distributions.

Frequency Distributions

There are two major types of frequency distributions: ungrouped frequency distributions and grouped frequency distributions. With an **ungrouped frequency distribution**, the number of times that each of the unique scores occurs in a data set is calculated. In our example, this would essentially be a count of how many students received a 32, how many received a 36, and so on. To create an ungrouped frequency distribution for the student exam scores, we would need to create a table with two columns—one column containing the various exam scores (sorted from smallest to largest) and another column indicating how frequently each of these scores occurred. Table B.2 shows an example of an ungrouped frequency distribution for the 30 exam scores.

> **ungrouped frequency distribution** a count of the number of times each specific data point or score appears in a data set.

Using this ungrouped frequency distribution, the instructor can readily see that the exam scores ranged from a low of 32 (with one person receiving that score) to a high of 67 (also with one person receiving this score). In addition, she can determine that seven people earned scores of either 50 or 51.

In the current example there are 21 unique exam scores. While this is a manageable number of categories, there are many instances where there are many more unique scores. As a result, the number of categories in an ungrouped frequency distribution becomes unmanageable. In such cases (and even in the present case, as we will see), you might want to create a **grouped frequency distribution** instead.

> **grouped frequency distribution** a count of the number of times specific data points fall into a range of values in a data set.

TABLE B.2

Ungrouped Frequency Distribution for 30 Exam Scores

Exam Score	Frequency
32	1
36	1
39	1
41	1
42	1
43	1
44	2
46	2
49	1
50	4
51	3
52	1
53	2
54	1
56	1
57	1
58	2
59	1
61	1
62	1
67	1
Total	**30**

To create a grouped frequency distribution, the instructor first creates a number of ranges, or classes of scores, to serve as the basis of the distribution. In general, there should be between five and 20 classes, and the classes need to be continuous (i.e., the classes need to encompass all of the scores from lowest to highest). **Table B.3** shows an example of a grouped frequency distribution for the 30 exam scores (each with a width of five scores). To complete the grouped frequency distribution, the instructor needs to determine how many of the 30 exam scores fall into each of the classes. For example, only one person had a score between 30 and 34 (i.e., the person who scored 32), so that class has a frequency of 1. There were two scores in the class of scores 35–39 (a 36 and a 39), so this class has a frequency of 2. The remainder of the frequencies for the classes are determined in a similar fashion.

Using this grouped frequency distribution, the instructor can identify aspects of the data set, such as there were 11 students who scored between 50 and 54, and there were only three students who scored less than 40.

Frequency distributions can be presented either in tabular format (as we have done in **Tables B.2** and **B.3**) or, following the adage that a picture is worth a thousand words, in some type of graphic form such as a histogram or a frequency polygon. **Histograms** are commonly used to graphically represent ungrouped frequency distributions. They are similar to bar charts and are constructed using a set of two axes. One axis, the horizontal or *x*-axis, contains an ordered listing of the various values for the scores from the ungrouped frequency distribution. The other axis, the vertical or *y*-axis, provides the frequency of those scores. **Figure B.1** shows a histogram based on the ungrouped frequency distribution for the 30 exam scores.

> **histogram** a bar chart showing the number of times specific data points fall into a range of values in a data set.

TABLE B.3

Grouped Frequency Distribution for 30 Exam Scores

Exam Score Classes	Frequency	Midpoint
30–34	1	32
35–39	2	37
40–44	5	42
45–49	3	47
50–54	11	52
55–59	5	57
60–64	2	62
65–69	1	67
Total	**30**	

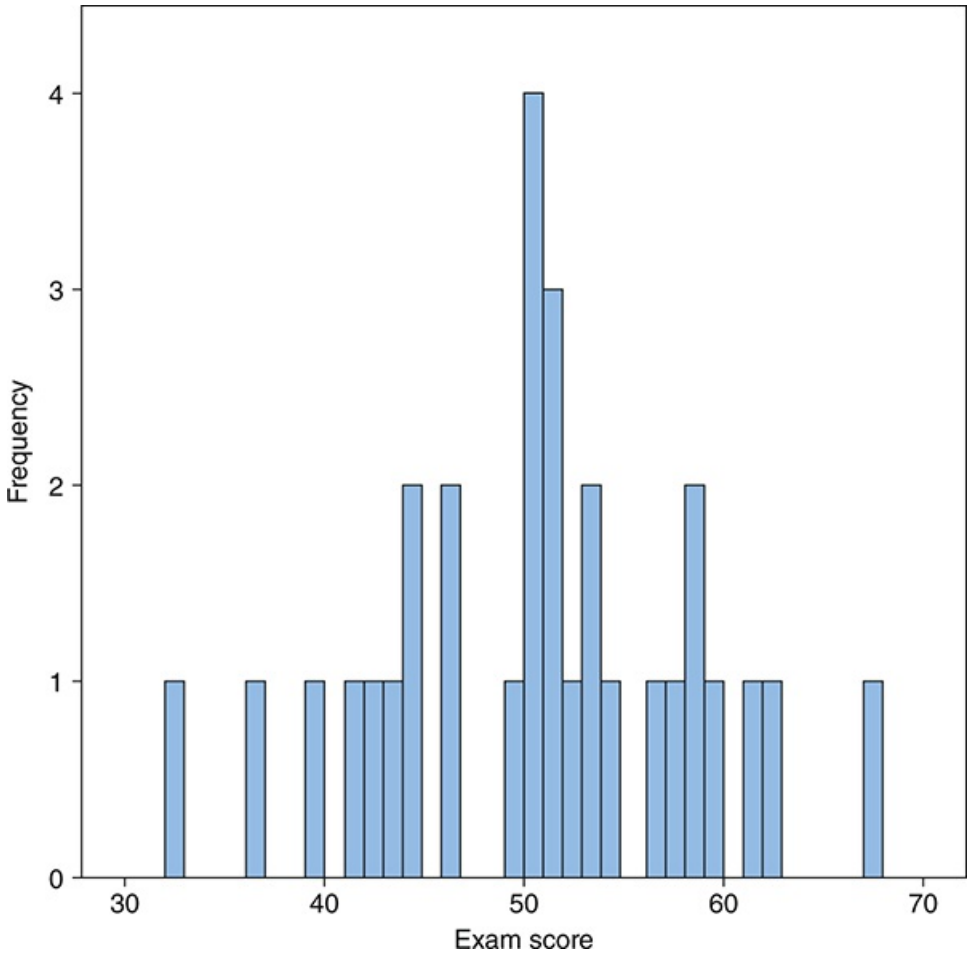


FIGURE B.1 Histogram for 30 exam scores

Frequency polygons are similar to histograms, but they are typically used to graphically represent grouped frequency distributions. Recall that a grouped frequency distribution summarizes the frequency of scores for each of a number of classes or ranges of scores. To create a frequency polygon from a grouped frequency distribution, you need to determine the *midpoint* (i.e., the centre) for each of the classes. In our example, the first class is from 30 – 34, so the midpoint of that class would be $32\left[\frac{30+34}{2}\right]$, with the remaining midpoints for the classes calculated in a similar way (see **Table B.3**). These midpoints are then included on the horizontal axis of the frequency polygon, and the frequencies for each of the classes are included on the vertical axis. **Figure B.2** provides a frequency polygon for the grouped frequency distribution for the 30 exam scores.

frequency polygon a line graph depicting a grouped frequency distribution, which is created by connecting the midpoints of each class of data.

Measures of Central Tendency

Another common use of descriptive statistics is to summarize a collection of data with a

single number that represents the entire data set. Such numbers are called **measures of central tendency**. For example, these numbers may be the most frequent number or a number that is thought to be typical of the data set. The three most common statistical measures of central tendency are the mean, median, and mode.

measures of central tendency numbers used to summarize data sets.

You most likely are already familiar with the **mean**—it is equivalent to the (arithmetic) average of the data set. As you know, to calculate an average (or the mean of a data set), total the numbers in the data set and divide by the total number of numbers. Returning to our example, to calculate the mean, total the 30 numbers and divide by 30. The total of the 30 scores is 1,505, so the mean (or average) of those scores is $\frac{1{,}505}{30} = 50.1667$.

mean the average value in a data set; the sum of all numbers in the set divided by the total number of items in the set.

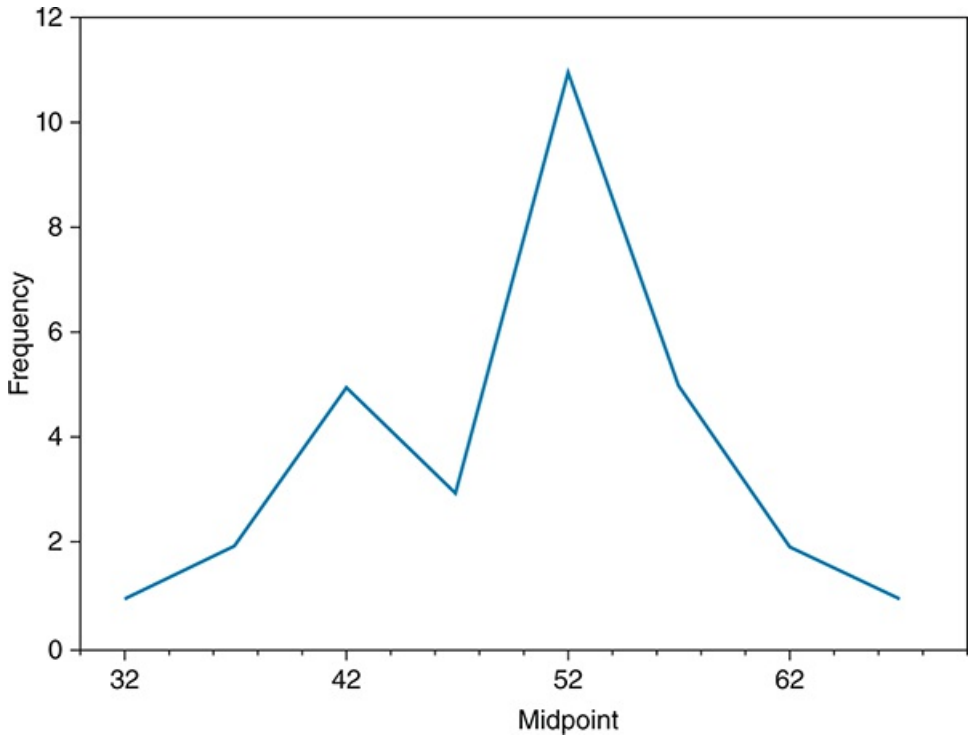


FIGURE B.2 Frequency polygon for 30 exam scores

Statisticians frequently use formulas to summarize the procedures required to calculate various statistical values (like the mean). The formula for the mean is presented below:

$$\alpha = \frac{\sum X}{N}$$

where: μ is the symbol for the mean,[1]

$\sum$ is summation notation and indicates the procedure of totalling the individual values in the data set,

X represents the possible values in the data set, and

N represents the number of observations.

While the mean is the average of the set of data, the **median** represents the midpoint or middle in an ordered set of data. That is, to determine the median for a set of data, first order the set of data (from smallest to largest) and then determine the midpoint of that ordered data set. Our 30 exam scores are sorted in **Table B.1**. Because there is an even number of scores (or observations), the exact midpoint for the data set would be between the 15th and 16th numbers. In cases where the number of observations (or *N*) is even, calculate the median by taking the average of the two middle numbers in the ordered data set. In our example, the 15th highest score is 50 while the 16th highest score is 51, so for this set of data the median is $50.5 \left(\frac{50 + 51}{2} \right)$. In cases where there are an odd number of observations in the data set, the median is simply the middle number in the ordered data set.

median the data set value that represents the midpoint of an ordered set of numbers.

A third measure of central tendency that may be calculated for a set of data is the **mode**, which is the most frequently occurring score or observation. The mode can be easily determined by looking at an ungrouped frequency distribution for the set of data. As **Table B.1** shows, the score of 50 was the most frequent score in our data set of 30 exam scores, with four of the 30 students earning that score. So for this set of data, the mode would be 50. In cases where there are multiple scores that each have equally high frequencies, then the data set has multiple modes (for example, if in our data set four people scored 50 and four people scored 58, then the data set would have two modes, 50 and 58).

mode the most frequent or most common value in a data set.

In summary, for our example set of data we have three measures of central tendency: a mean of 50.1667, a median of 50.5, and a mode of 50. As you can see, for this set of data the three measures of central tendency are similar to one another, and you may wonder which is the "best" measure of central tendency. We will return to this question later in the appendix.

Measures of Variability

Whereas measures of central tendency provide some idea of a typical number in a set of data, they do not tell us anything about how different the numbers in a set of data are from one another. Statistics that do this are known as **measures of variability**.

measures of variability indicators that tell how different the values are within a data set.

The simplest measure of variability for a set of data is the **range**, which is the difference between the largest and the smallest values in a data set. To calculate the range for our 30 exam scores, determine the largest and the smallest score and then take the difference between them. Referring to **Table B.1** the largest score is 67 while the smallest score is 32, so the range of scores is 35 (67 − 32 = 35). One advantage of the range is that it is easy to calculate, but it does have a major shortcoming: for any set of data, the range is based only on two scores and, by definition, these are extreme scores (i.e., they are the largest and smallest scores). As such, the size of the range is influenced by any extreme score, and further, the range only provides limited information about how different each of the numbers in a set of data are from one another.

range the difference between the smallest and the largest value in a data set.

To deal with the shortcomings of the range, there are a couple of related measures of variability: the variance and the standard deviation. Let's say we wanted to calculate, on average, how different each number in a set of data is from the mean. To do this we would have to calculate what is referred to as a *deviation score* for each of the observations (these are calculated by taking the difference between each score and the mean) and then calculate the average of those deviation scores (see **Table B.4**). However, when we follow this procedure a problem arises: to calculate the average of the deviation scores, we have to take the total of those scores and divide this total by the number of scores. Whenever we do this (for any set of scores), the total of the deviation scores will always be 0 (regardless of how different the scores are from one another). Thus, the average of the deviation scores is always 0 for every set of data and, as such, it is not very useful as a possible measure of variability.

Statisticians deal with this problem by calculating another measure of variability, known as the variance. The **variance** is the average of the squared deviation scores. The resulting set of scores has the property that the larger the squared deviation, the further that observation is from the mean. Thus, the larger the variance is for a set of data, the more different the scores are from one another. To calculate the variance for our 30 exam scores, take the average of the squared deviation scores, which gives a variance of 60.94 $\left(60.94 = \frac{1{,}828.167}{30}\right)$; see **Table B.4**).

variance a calculated indicator of the degree to which values in a data set differ from the mean value of that data set; the average of squared deviations about the mean.

The formula for the variance is presented below:

$$\sigma^2 = \frac{\sum (X - \mu)^2}{N}$$

where: σ^2 is the symbol for the variance,[2]

$\sum$ is summation notation and indicates the procedure of totalling the individual

squared deviation scores $(X = \mu)^2$, and

N represents the number of observations.

While the variance is a useful measure of variability in that its magnitude reflects how different the numbers in a set of data are from one another, it also has a major shortcoming: the variance is not in the same metric as the original scores. For example, in calculating the variance, we determined the average of the squared deviations, so for our example the variance was approximately 61. However, that 61 is in the metric of *squared* exam scores, not the original exam scores we started with. To have a measure of variability that is in the same metric as the original scores, we calculate the **standard deviation**—the square root of the variance. In our example of 30 exam scores, the standard deviation is 7.81 $(7.81 = \sqrt{60.94})$. The benefit of using the standard deviation as compared to the variance is that this measure of variability is in the same metric as the original scores.

standard deviation a deviation value that is the square root of the variance; it is a statistical index of how much scores vary within a group.

TABLE B.4

Thirty Exam Scores with the Mean, Deviation Score, and Squared Deviation Score

	Exam Score (X)	Mean (μ)	Deviation Score ($X - \mu$)	Squared Deviation Score $(X - \mu)^2$
	32	50.1667	−18.17	330.029
	36	50.1667	−14.17	200.695
	39	50.1667	−11.17	124.695
	41	50.1667	−9.17	84.028
	42	50.1667	−8.17	66.695
	43	50.1667	−7.17	51.362
	44	50.1667	−6.17	38.028
	44	50.1667	−6.17	38.028
	46	50.1667	−4.17	17.361
	46	50.1667	−4.17	17.361
	49	50.1667	−1.17	1.361
	50	50.1667	−0.17	0.028
	50	50.1667	−0.17	0.028
	50	50.1667	−0.17	0.028
	50	50.1667	−0.17	0.028
	51	50.1667	0.83	0.694
	51	50.1667	0.83	0.694

	51	50.1667	0.83	0.694
	52	50.1667	1.83	3.361
	53	50.1667	2.83	8.028
	53	50.1667	2.83	8.028
	54	50.1667	3.83	14.694
	56	50.1667	5.83	34.027
	57	50.1667	6.83	46.694
	58	50.1667	7.83	61.361
	58	50.1667	7.83	61.361
	59	50.1667	8.83	78.027
	61	50.1667	10.83	117.360
	62	50.1667	11.83	140.027
	67	50.1667	16.83	283.360
Totals	**1,505**	**1,505**	**0.00**	**1,828.167**

Frequency Distributions—Again

If we were to obtain a very large number of measurements of one of a variety of human characteristics (e.g., physical characteristics like height or weight or psychological variables like intelligence or anxiety) and plot the frequency of the various values, we would find that the majority of scores fall near the middle of that frequency distribution. Comparatively fewer scores are associated with the more extreme values. Such distributions frequently resemble a theoretical distribution known as a **normal distribution** (sometimes, because of its shape, it may be referred to as a **bell curve**).

> **normal distribution or bell curve** a symmetrical, bell-shaped distribution in which most scores are in the middle with smaller groups of equal size at either end.

Normal distributions all have the same basic shape, but vary depending upon the mean and the standard deviation for the data. For example, scores on the Wechsler Adult Intelligence Scale (WAIS), discussed in Chapter 10, are designed to follow the normal distribution with a mean of 100 and a standard deviation of 15 (see **Figure B.3**).

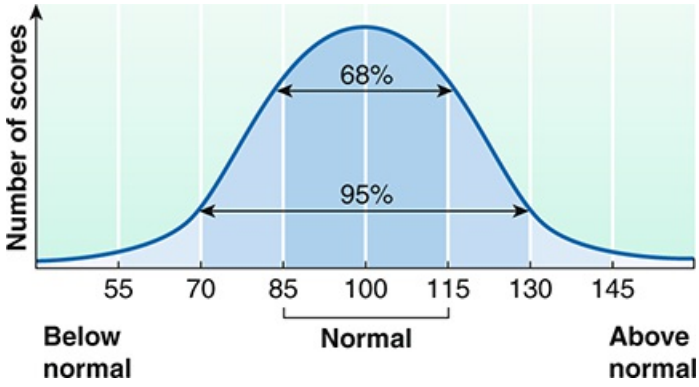


FIGURE B.3 A normal distribution

Once we know that a set of scores (at least theoretically) follows a normal distribution, then we also know certain things about how those scores are distributed. First, the normal distribution is a *symmetrical distribution*—that is, the bottom half of the distribution is the same shape as the top half. Also, with the normal distribution, the three measures of central tendency, the mean, the median, and the mode, all fall in the exact same location. Based on this we know that in the case of WAIS scores that have a mean of 100, 50 percent of individuals will have scores less than 100 and similarly, 50 percent of individuals will have scores greater than 100. Further, theoretically, approximately 68 percent of people will score within plus or minus one standard deviation of the mean (i.e., between 85 and 115), and similarly about 95 percent of people will score within plus or minus two standard deviations of the mean (i.e., between 70 and 130).

Not all variables follow a normal distribution. In many instances, a large data set may have a comparatively small number of scores that are either very low or very high. For example, consider the distribution of 2010–2011 salaries for players from the Toronto Maple Leafs (Sports City, 2011). In this team, as is common in many teams in the NHL, there are a few premiere players who receive considerably higher than normal salaries, which results in a **positively skewed distribution** (sometimes referred to as a *distribution skewed to the right*). As **Figure B.4** reflects, in situations where the distribution is positively skewed, the average (or mean) for the distribution is considerably larger than the median value since the few extremely large salaries are included in the calculation of the mean. The mode also tends to be less than the median, which is also typical in positively skewed distributions.

positively skewed distribution a distribution where most values occur at the lower end of the scale.

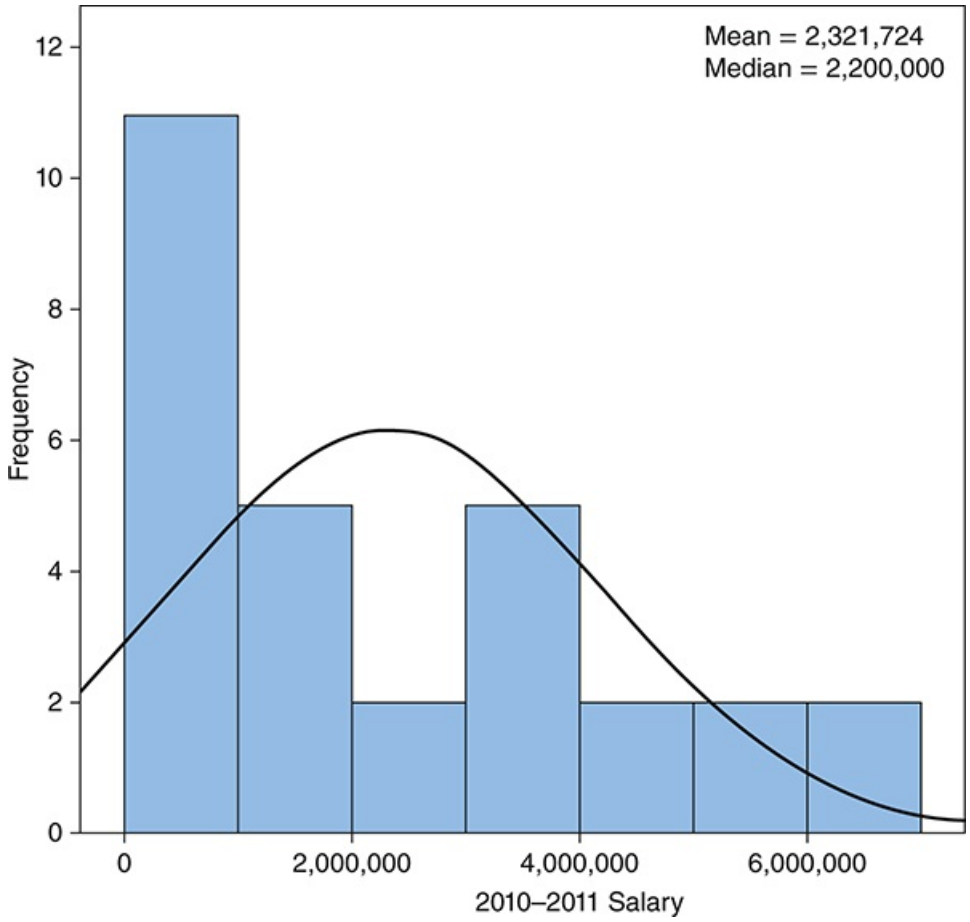


FIGURE B.4 Example of a positively skewed distribution

In other instances, a distribution of scores may contain comparatively few low scores along with many more higher scores. For example, consider a nine-item true–false quiz that an instructor might give to an introductory psychology class with 250 students. Assume that the test is quite easy, so most of the students do very well. This could result in a distribution of scores such as the one depicted in **Figure B.5**. As you can see, the mean is less than the median (again, this is because the value for the mean is influenced by the comparatively few small scores), which is also less than the mode. These types of distributions are called **negatively skewed distributions** (sometimes referred to as a *distribution skewed to the left*).

negatively skewed distribution a distribution where most values occur at the upper end of the scale.

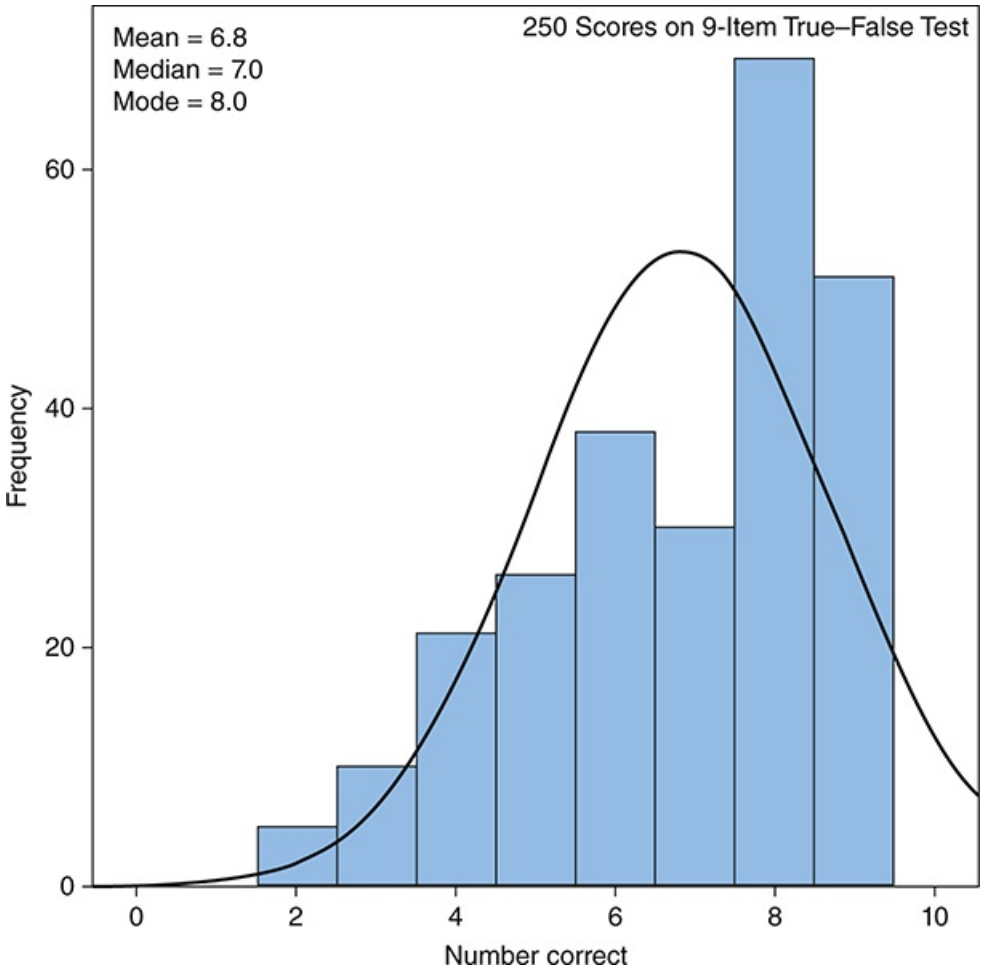


FIGURE B.5 Example of a negatively skewed distribution

In summary, if a distribution has comparatively few small or high scores, the mean may not be the best measure of central tendency since it is the only measure of central tendency that is influenced by these types of extreme scores. In such cases, the median or mode may be a better, more representative measure of central tendency.

Measures of Association

In many situations, psychologists are interested in studying the relationship between two (or more) variables. For example, what is the relationship between exposure to televised violence and actual physical aggression? Or is there a relationship between exposure to actors smoking in the media (e.g., in movies and television) and the likelihood of a teenager deciding to start smoking? In instances such as these, we can quantify and summarize the degree of relationship or association between variables using descriptive statistics known as **measures of association**.

measures of association descriptive statistics that quantify and summarize the degree of relationship or association between variables.

Recall our earlier example where we had scores from 30 students on their first psychology test (refer to this variable as *X*). Suppose that we had also asked those same 30 students the following question: "In the week before the test, how many hours did you spend playing video games?" (call this variable *Y*). **Table B.5** provides a listing of these data.

In instances where we have collected data on two variables from a group of individuals, it is possible to represent the relationship between the two variables using a display known as a **scatterplot** (or scattergram). In this display, values of one of the variables are plotted on the horizontal axis of the graph and the corresponding values of the other variable are plotted on the vertical axis. **Figure B.6** provides a scatterplot of our example data. On average, higher exam scores are associated with students who spent less time playing video games. Similarly, students who received the lower exam scores, on average, spent more time playing video games in the week before the exam.

> **scatterplot** a graph or plot of the values of one variable or measure associated with the values on another variable or measure.

While we can understand the nature of the relationship between two variables using scatterplots, we might want to have an index or number that reflects the nature of that relationship. The most commonly used measure of association between two variables is the **Pearson product-moment correlation coefficient** (often symbolized with an *r* and frequently referred to as simply the correlation coefficient). The correlation coefficient provides an index of the degree of (linear) relationship between two variables, with possible values of the coefficient ranging between −1 and +1. The value of the correlation coefficient reflects both the *magnitude* of the relationship between the two variables and the *direction* of the relationship between the two variables. Positive values of the correlation coefficient ($r > 0.00$) indicate that there is a **positive** or **direct relationship** between the variables. In instances like this, higher values on one of the variables are associated, on average, with higher values on the other variable; similarly, lower values of the one variable are associated, on average, with lower values of the other variable. In cases where the correlation coefficient is negative (i.e., $r < 0.00$), the nature of the relationship between the two variables is referred to as a **negative** or **inverse relationship**. In this case, the lower scores on one variable are, on average, associated with higher scores on the other variable and vice versa (as was the case with our example data).

> **Pearson product-moment correlation coefficient** a statistic indicating the degree of association or relationship between two variables or measures, ranging from −1 to +1.
>
> **positive or direct relationship** a relationship where as the value of one variable increases, so do values in another associated variable.
>
> **negative or inverse relationship** a relationship where as the value of one variable increases, values in another associated variable decrease.

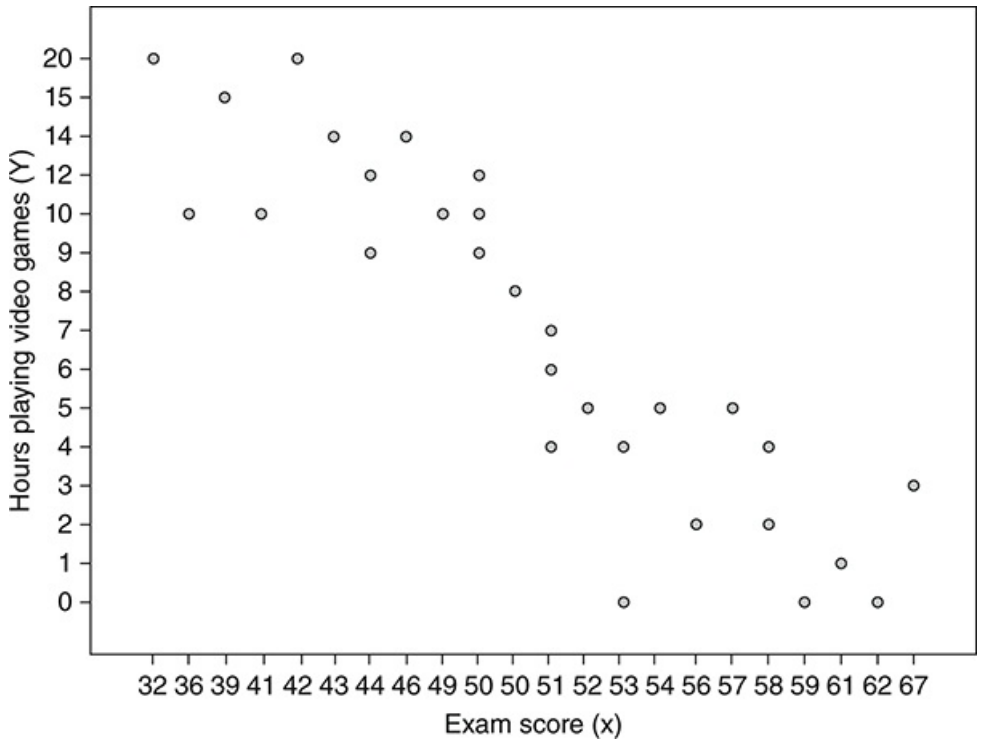


FIGURE B.6 Scatterplot showing exam scores and hours of video game playing

TABLE B.5

Exam Scores and Hours of Video Game Playing

Student	Exam Score (*X*)	Hours Playing Video Games (*Y*)
1	32	20
2	36	10
3	39	15
4	41	10
5	42	20
6	43	14
7	44	8
8	44	12
9	46	14
10	46	14
11	49	10
12	50	12
13	50	8
14	50	10

15	50	8
16	51	6
17	51	7
18	51	4
19	52	5
20	53	0
21	53	4
22	54	5
23	56	2
24	57	5
25	58	4
26	58	2
27	59	0
28	61	1
29	62	0
30	67	3

Figure B.7 provides an example of a number of scatterplots depicting varying degrees of relationship between the two variables. The left-most scatterplots reflect instances of positive and negative perfect relationships (i.e., $r = +1$ and $r = -1$). In instances like these, values on one variable change on a one-to-one basis with changes in the other variable and the relationship can be represented with a straight line. Such relationships are rarely observed in real life. As we move to the right in **Figure B.7**, as the degree of relationship between the variables decreases, the data points in the scatterplot no longer fall on a straight line. Further, with decreases in the degree of relationship, the points in the scatterplot fall farther from the straight line.

As previously mentioned, the value of the correlation coefficient reflects both the *direction* and the *magnitude* of the relationship between the two variables. To interpret the magnitude of the relationship reflected, we need to consider the absolute value of the correlation (i.e., ignoring whether or not it is positive or negative). The closer the absolute value of the correlation coefficient is to 1, the stronger the degree of relationship between the two variables. An alternative way of understanding the magnitude of the relationship is to take the square of the correlation coefficient (i.e., r^2). This value is known as the **coefficient of determination** and indicates the degree to which values on one variable can be predicted by knowing the values of the other variable. For example, if the correlation between number of cigarettes smoked and life expectancy were $r = 0.80$, then we could predict with 64 percent accuracy a person's life expectancy based on how much he or she had smoked.

coefficient of determination the degree to which values on one variable can be predicted by knowing the values of the other variable.

To calculate the Pearson product-moment correlation coefficient, take the ratio of the covariance between the two variables (which is another measure of association) and divide that by the product of the standard deviations of the two variables. The covariance between two variables (let's call them X and Y) is defined by the following formula:

$$\sigma_{XY} = \frac{\sum (X - \mu_X)(Y - \mu_Y)}{N}$$

where: σ_{XY} is the symbol for the covariance,[3]

$\sum$ is summation notation and indicates the procedure of totalling the products of each pair of deviation scores $(X - \mu_X)$ and $(Y - \mu_Y)$, and

N represents the number of observations.

Table B.6 shows our example data looking at the relationship between students' exam scores (X) and hours spent playing video games (Y). The table includes the details on the initial calculations required to determine the variances for each of the variables and the covariance between the two variables.

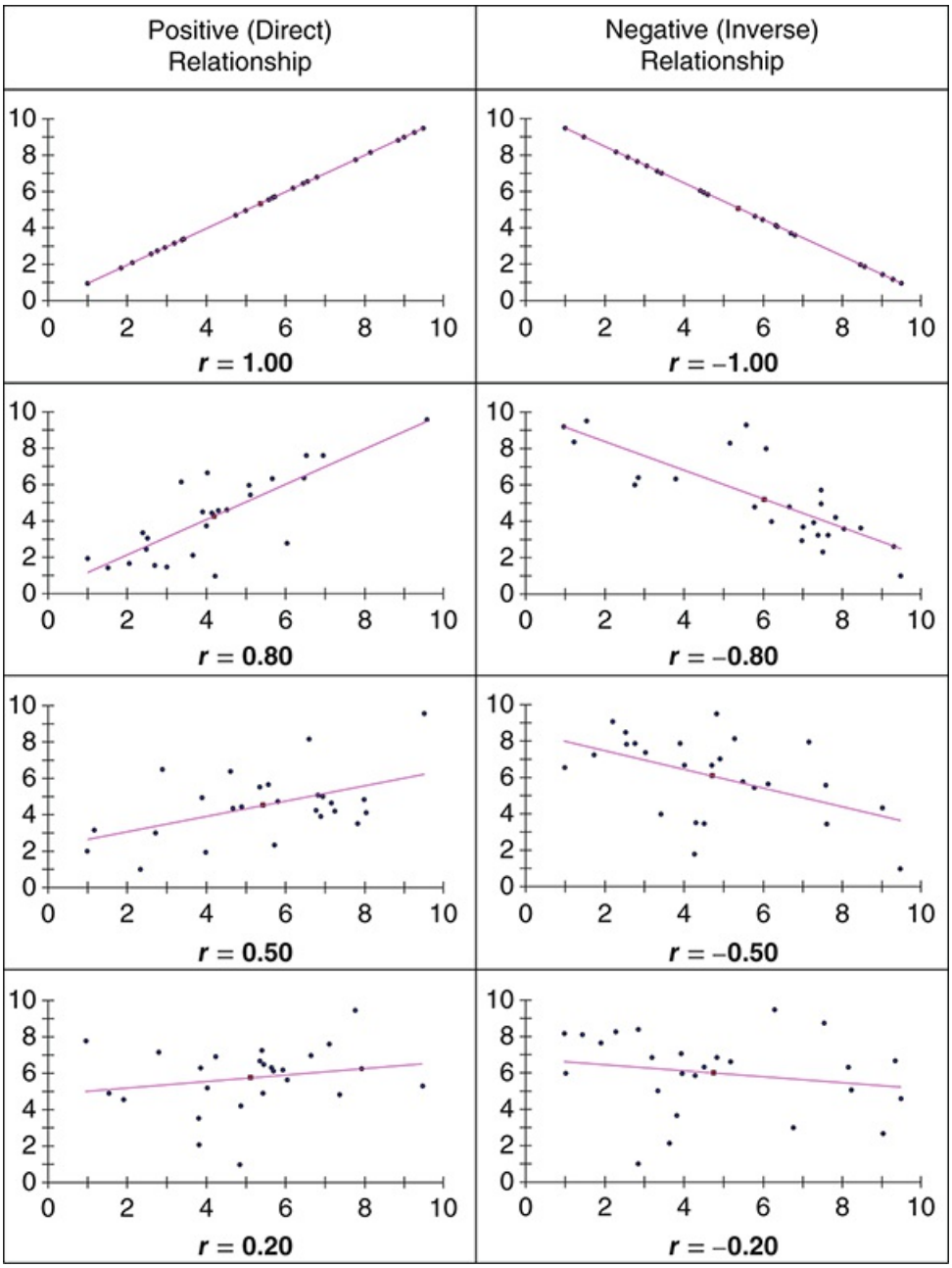


FIGURE B.7 Scatterplots showing various degrees of relationship

First, consider the covariance between the two variables. The numerator for the covariance is based on the sum of the product of the individual pairs of deviation scores (ie., $\sum(X - \mu_X)(Y - \mu_Y)$).

In this example the total is negative, which reflects the inverse relationship that exists between the students' exam scores and the number of hours they spent playing video games. On average, the students who had higher exam scores, and who therefore also had positive deviation scores for that variable ($X - \mu_X$), were more likely to have spent less time playing video games, and therefore had negative deviation scores for that variable ($Y - \mu_Y$).

Further, the reverse is true for students who had lower exam scores. When this happens, the covariance between the two variables will be negative and this will result in the correlation between the two variables being negative as well, since the covariance serves as the numerator for the correlation.[4] For our example data, the covariance between the two variables is:

$$\sigma_{XY} = \frac{\sum (X - \mu_X)(Y - \mu_Y)}{N} = \frac{-1{,}077.83}{30} = -35.93$$

The next step in calculating the correlation coefficient is to determine the standard deviation for each of the variables. Recall that the standard deviation for a variable is the square root of the variance. The variance for each of the two variables can be calculated as shown below:

$$\sigma_X^2 = \frac{\sum (X - \mu_X)^2}{N} = \frac{1{,}828.17}{30} = 60.94 \text{ and } \sigma_Y^2 = \frac{\sum (Y - \mu_Y)^2}{N} = \frac{909.37}{30} = 30.31$$

TABLE B.6

Data Required for Calculating Pearson Correlation Coefficient

Student	Exam Score (X)	Hours Playing Video Games (Y)	$X - \mu X$	$Y - \mu Y$	$(X - \mu X)(Y - \mu Y)$	$(X - \mu X)^2$	$(Y - \mu Y)^2$
1	32	20	−18.17	12.23	−222.24	330.03	149.65
2	36	10	−14.17	2.23	−31.64	200.69	4.99
3	39	15	−11.17	7.23	−80.77	124.69	52.32
4	41	10	−9.17	2.23	−20.47	84.03	4.99
5	42	20	−8.17	12.23	−99.91	66.69	149.65
6	43	14	−7.17	6.23	−44.67	51.36	38.85
7	44	8	−6.17	0.23	−1.44	38.03	0.05
8	44	12	−6.17	4.23	−26.11	38.03	17.92
9	46	14	−4.17	6.23	−25.97	17.36	38.85
10	46	14	−4.17	6.23	−25.97	17.36	38.85
11	49	10	−1.17	2.23	−2.61	1.36	4.99
12	50	12	−0.17	4.23	−0.71	0.03	17.92
13	50	8	−0.17	0.23	−0.04	0.03	0.05
14	50	10	−0.17	2.23	−0.37	0.03	4.99
15	50	8	−0.17	0.23	−0.04	0.03	0.05
16	51	6	0.83	−1.77	−1.47	0.69	3.12

16	51	6	0.83	−1.77	−1.47	0.69	3.12
17	51	7	0.83	−0.77	−0.64	0.69	0.59
18	51	4	0.83	−3.77	−3.14	0.69	14.19
19	52	5	1.83	−2.77	−5.07	3.36	7.65
20	53	0	2.83	−7.77	−22.01	8.03	60.32
21	53	4	2.83	−3.77	−10.67	8.03	14.19
22	54	5	3.83	−2.77	−10.61	14.69	7.65
23	56	2	5.83	−5.77	−33.64	34.03	33.25
24	57	5	6.83	−2.77	−18.91	46.69	7.65
25	58	4	7.83	−3.77	−29.51	61.36	14.19
26	58	2	7.83	−5.77	−45.17	61.36	33.25
27	59	0	8.83	−7.77	−68.61	78.03	60.32
28	61	1	10.83	−6.77	−73.31	117.36	45.79
29	62	0	11.83	−7.77	−91.91	140.03	60.32
30	67	3	16.83	−4.77	−80.24	283.36	22.72
Totals (Σ)	**50.167**	**7.767**	**0.00**	**0.00**	**−1,077.83**	**1,828.17**	**909.37**

To obtain the standard deviations for the two variables, take the square roots of the two variances $\left(\text{ie.,} \sigma_X = \sqrt{60.94} = 7.81 \text{ and } \sigma_Y = \sqrt{30.31} = 5.51\right)$. Finally, take the covariance and divide it by the product of the two standard deviations[5]:

$$r = \frac{\rho_{XY}}{\sigma_X \sigma_Y} = \frac{-35.93}{7.81 \times 5.51} = -0.84$$

So, for our 30 students, the correlation between their exam scores and the amount of time spent playing video games is −0.84. In other words, we could predict with about 70 percent accuracy (i.e., 0.84^2) a student's exam score if we knew how many hours that person had spent playing video games. Finally, as discussed in Chapter 2, remember that correlations tell us nothing regarding causality. So even though there is a fairly strong negative relationship between exam scores and video game playing in our example data, we do not know whether one variable causes the other or whether there is some third variable that is responsible for the relationship. So video gaming might reduce exam scores, or low exam scores might increase video gaming, or low exam scores and high amounts of video gaming might both be due to a lack of interest in or commitment to the course in question.

Inferential Statistics

Whereas psychologists (and others) use descriptive statistics to summarize collections of data, they use *inferential statistics* to help them make informed decisions regarding the types of conclusions they can make regarding their research findings. To understand this better, let's begin with some definitions and an example.

Populations and Samples

In most cases, when psychologists conduct research (whether on human participants or animal subjects), what they are doing is collecting observations based on a **sample** of individuals that is drawn from a larger group or **population** (see Figure B.8). Consider a simple experimental study where a psychologist is interested in testing the effectiveness of a new drug to improve memory. It would be impractical (and very expensive) to test every individual who might take the drug, so the researcher obtains a sample of individuals, studies them, and then draws some type of conclusions based on the results of that study. Let's look at this procedure in more detail.

sample a group or set of people or items drawn from a larger population.

population the entire group of individuals about whom we hope to learn (e.g., the Canadian population consists of all Canadians).

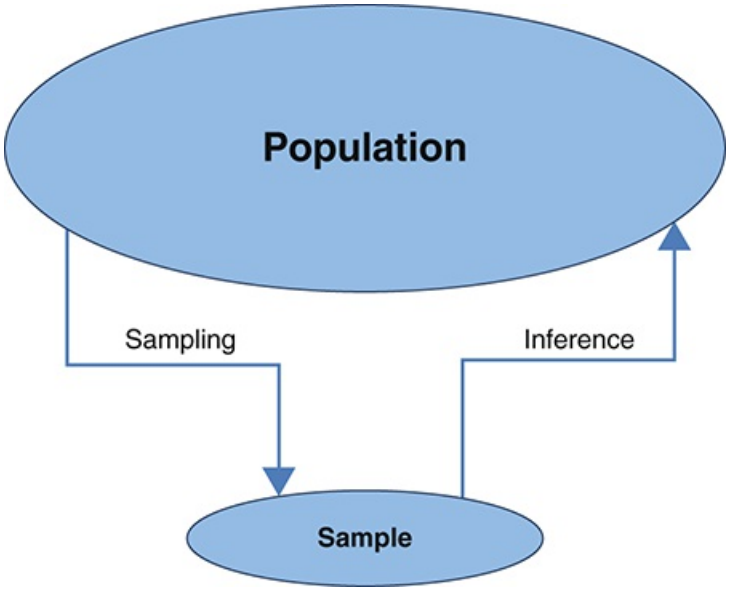


FIGURE B.8 Relationship between population and samples

First, consider the underlying population—the group about which the psychologist ultimately wants to make conclusions—from which the psychologist is going to obtain her sample. In the case of testing a drug that supposedly improves (human) memory, we might consider the population to be all adults in North America. Since the psychologist cannot test the effect of the drug on all members of the population, she instead obtains a sample of individuals from that population. Often the ideal type of sample to obtain would be a **random sample**, in which every member of the population has an equal chance of being selected for the study. However, in many instances it is not possible to obtain a truly random sample. Instead researchers rely on sampling from a group of individuals to which they have access (e.g., first-year psychology students).

random sample a group or set made by randomly selecting people or items from a larger population; like closing your eyes and picking any two socks from your drawer.

Assume that the psychologist has recruited 50 participants for her study. This study will involve two groups: the experimental group, which will receive the drug and then will have their memory tested, and a control group that will consist of participants who are treated exactly the same as the participants in the experimental group with the exception that they will not receive the drug.[6] In conducting the experiment, the researcher might randomly assign 25 participants to each of the two conditions (e.g., participants could be assigned to the experimental vs. control groups based on the results of the flip of a coin). Random assignment helps to ensure that any differences that might have existed between the two groups are evenly distributed between the groups so that the two groups are as similar as possible at the start of the study.

Hypothesis Testing

Assume that memory is assessed in this study with a standard memory test, and the researcher finds that the average score for the experimental group is 50 whereas the average score for the control group is 25. At this point, the psychologist can conclude that, on average, the experimental group had better performance on the memory test than did the control group, which she could attribute to the effect of the drug. However, the more interesting question, and the one that is at the heart of inferential statistics, is whether or not a similar finding would be obtained if the drug were given to other individuals in the population. The answer to this question comes down to the psychologist determining whether or not the difference observed between the two groups in the sample is "big enough" for her to conclude that similar differences would likely occur if the study was conducted again with a different sample of individuals.

To address this question, the psychologist can employ a technique known as **hypothesis testing**. With hypothesis testing, the psychologist sets up two hypotheses: the null hypothesis and the alternative hypothesis. Under the **null hypothesis**, the psychologist asserts that in the underlying population from which the sample was obtained, there is no difference between the average performance of individuals who might receive the drug and those who might not receive the drug (in other words, this null hypothesis asserts that the memory drug is *not* effective). The **alternative hypothesis** would be that in the population from which the sample was obtained, the average performance on the memory test for individuals receiving the memory drug would be better than that for individuals not receiving the drug (in other words, asserting that the memory drug *is* effective).

> **hypothesis testing** testing a statement or claim about a population using a sample and, in its simplest form, looking at experimental and control group differences.
>
> **null hypothesis** an assertion that in the underlying population from which the sample was obtained, there is no difference between the average performance of individuals in one group compared to another.
>
> **alternative hypothesis** an assertion that in the underlying population from which the sample was obtained, there *is* a difference between the average performance of individuals in one group compared to another.

When the psychologist conducts her memory drug study, she obtains her sample of 50

individuals from the underlying population and uses that sample to create two groups. Theoretically, she could have obtained many other, different samples from that population. In this particular study, the researcher finds that there is a 25-point difference between the average memory performance for participants in the control group and those in the experimental group. Now the inferential question is, how likely is it that she would have found a difference of 25 points between the two sample means *if* the null hypothesis was true (i.e., if there really was no difference in people's memory between those who receive the memory drug and those who do not)? To determine the likelihood of this finding, the psychologist needs to consider a theoretical distribution known as a **sampling distribution**. In this case, the psychologist would consider a sampling distribution for the difference between two sample means (or averages) that are taken from an underlying population in which there is no difference between the means. The characteristics of this sampling distribution are based on the variability of the sample data and the size of the samples.

> **sampling distribution** the theoretical distribution of a sample statistic; for example, the difference between two sample means taken from a population.

In our example, assume that the standard deviation for scores on the memory test was 20 for the control group and 30 for the experimental group. If the null hypothesis was true, then we would know theoretically that all possible differences between two sample means would be normally distributed with a mean of 0 and a standard deviation of 7.21.[7] Given that we know the characteristics of the theoretical sampling distribution, we can calculate that the likelihood or probability of finding a difference of 25 points between the two sample means would be very low (in fact, it would be less than 1 chance in 1,000). In this case, the psychologist would reject the null hypothesis and could be reasonably confident in concluding that the finding she obtained in her study was not due to chance and that the drug really had some effect on memory performance.

When psychologists test hypotheses using the procedures outlined above, before analyzing their data, they determine what level of risk they would be willing to take in terms of making an incorrect conclusion. Typically psychologists set the risk of drawing an incorrect conclusion at a level of either *less than 5 in 100* times or, if they want to be more certain (and more conservative) *less than 1 in 100* times. These levels translate to what is known as the **significance level,** or the **rejection level**, for the hypothesis test, and are often reported in the literature as finding a significant difference between the groups at $p < 0.05$ or $p < 0.01$. In practice, if a psychologist ends up rejecting the null hypothesis, she concludes that there is evidence to support the alternative hypothesis (e.g., that the memory drug is effective)—what she cannot say, however, is that she has "proven" the alternative hypothesis. This is because we only have information from the one sample and there is still some possibility (albeit a low one) that the sample she obtained did indeed come from a population where the drug had no effect on memory.

> **significance level** or **rejection level** the level of risk researchers would be willing to take in terms of making an incorrect conclusion.

Effect Size

Whereas inferential statistics provide psychologists with tools to determine the likelihood of the finding in the sample being one that would also occur in the population, they do not provide information regarding the magnitude of the study's effect. For example, while a psychologist may use null hypothesis testing to find that there is a significant difference between memory performance for two groups, the hypothesis test does not tell us about the magnitude or size of the difference—it only allows the psychologist to make a statement regarding the probability of the finding. Researchers can use another category of descriptive statistics, namely **effect size** estimates, in conjunction with hypothesis testing to help them assess the magnitude of research findings. An effect size is a standardized measure that reflects the degree of relationship or size of the difference between two or more variables. Further, since effect sizes are standardized, they can be compared across different studies (Field, 2005).

> **effect size** a standardized measure that reflects the degree of relationship or size of the difference between two or more variables.

Two common categories of effect sizes are (1) group difference indices that estimate the magnitude of the difference between two (or more) groups; and (2) strength of association indices that estimate the degree of shared variation between two (or more) variables (Ferguson, 2016). In simple studies that involve examining the difference in average performance between two groups, Cohen's *d* is the most common effect size. Cohen's *d* is the standardized difference between two population means and can be estimated by taking the difference between the two sample means and dividing this by the standard deviation for the data. In the previous memory study example there was a 25-point difference between the two sample means; if we divide that by the standard deviation[8] of the data, then Cohen's *d* equals $0.98 \left(d = \frac{25}{25.5} = 0.98 \right)$. In terms of interpreting effect sizes (specifically Cohen's *d*), a frequently used rule-of-thumb is to define effect sizes as "small, *d* = .2," "medium, *d* = .5," and "large, *d* = .8" (Cohen, 2003). Thus, for the example data, we could conclude that the memory drug has a large effect.

For non-experimental studies, a common effect size that is a measure of association is the Pearson correlation coefficient (i.e., *r*). In terms of interpreting *r* as an effect size, Cohen (1992) suggests the following: "small, *r* = .1," "medium, *r* = .3," and "large, *r* = .5" Recall that squaring the correlation coefficient provides the coefficient of determination, which tells us how much of the variability in one variable can be predicted based on scores from the other variable. With this in mind, for non-experimental research, if one could account for 1 percent of the variability, then you would have a small effect; if you could account for 9 percent of the variability, then you would have a medium effect; and if you could account for 25 percent of the variability, you would have a large effect.

Why Statistics Matter

This appendix has hopefully provided you with some insight into several of the basic

statistical procedures used by psychologists as tools to summarize and interpret the data they collect as part of their research studies. Students of psychology are often surprised by the degree to which the study of psychology requires at least a basic familiarity with statistics. However, only with this type of understanding will students become better consumers of psychological research and thereby become better able to critically evaluate the claims made by psychologists. In fact, students who choose to major in psychology as undergraduates will most likely require further instruction in statistics. A survey of requirements for undergraduate degrees in psychology by the American Psychological Association showed that the vast majority of universities and colleges require at least one course in statistics (Norcross et al., 2016). So if you are interested in pursuing a degree in psychology, you can expect to encounter even more statistics.

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Notes

1 μ is the symbol for the mean of a population, whereas $\overline{X}$ is the symbol for the mean of a sample. The distinction between populations and samples is discussed later in this appendix.

2 σ^2 is the symbol for the variance of a population, whereas s^2 is the symbol for the variance of a sample. The distinction between populations and samples is discussed later in this appendix.

3 σ_{XY} is the symbol for the covariance of a population, whereas S_{XY} is the symbol for the covariance of a sample. The distinction between populations and samples is discussed later in this appendix.

4 Note that when there is a positive relationship between the two variables, higher scores on one variable will on average be associated with higher scores on the other variables (thus the product of the corresponding deviation scores will be positive). Additionally,

lower scores on one variable will on average be associated with lower scores on the other variable (and in this case, the two corresponding deviation scores will both be negative and therefore their product will be positive). In cases like this, the covariance between the two variables will be a large positive value, which will result in the correlation between the two variables being positive.

5 This formula for the correlation coefficient is really more of a "definitional" formula and would only be used if the number of observations was small. In most instances, the correlation coefficient is calculated using one of several alternative "calculational" formulas.

6 In a well-designed study, the participants in the control group would not know that they were in the control group and would be administered some type of placebo (e.g., a sugar pill).

7 This standard deviation is known as the *standard error of the differences between means* and equals $\sqrt{\frac{20^2}{25} + \frac{30^2}{25}} = 7.21$.

8 In the case of the example study, the standard deviation of the data is obtained by using the pooled standard deviation, which can be calculated as

$$s^\star = \sqrt{\frac{(n_1 - 1)\, s_1^2 + (n_2 - 1)\, s_2^2}{n_1 + n_2 - 2}} = \sqrt{\frac{(25 - 1)20_1^2 + (25 - 1)30_2^2}{25 + 25 - 2}}$$

$$= 25.5$$

Glossary

A

ABC model of attitudes
a model proposing that attitudes have three components: the affective component, the behavioural component, and the cognitive component.

abnormal psychology the scientific study of psychological disorders. **absolute pitch**
the ability to recognize or produce any note on a musical scale. **absolute refractory period**
a very brief period of time after an action potential, during which a neuron is completely unable to fire again.

absolute threshold
the minimal stimulus necessary for detection by an individual 50 percent of the time.

academic psychology
a branch of psychology focusing on research and instruction in the various areas or fields of study in psychology.

accommodation
one of two ways of acquiring knowledge, defined by Piaget as the alteration of pre-existing mental frameworks to take in new information.

action potential
a sudden positive change in the electrical charge of a neuron's axon, also known as a spike or firing; action potentials are rapidly transmitted down the axon.

activation-synthesis model
theory that dreams result from the brain's attempts to synthesize or organize random internally-generated signals and give them meaning.

actor–observer effect
the discrepancy between how we explain other people's behaviour (dispositionally) and how we explain our own behaviour (situationally).

acute stress disorder
an anxiety disorder in which fear and related symptoms are experienced soon after a traumatic event and last less than a month.

acute stressor
a stressful situation or circumstance that happens in the short term and has a definite endpoint.

adaptive theory of sleep
theory that organisms sleep for the purpose of self-preservation, to keep away from predators that are more active at night.

addiction
psychological or physical compulsion to take a drug, resulting from regular ingestion and leading to maladaptive patterns of behaviour and changes in physical response.

afferent neurons neurons that carry sensory information from the body to the CNS.

affiliation
the need to form attachments to other people for support, guidance, and protection.

ageusia inability to taste. **aggression**
a broad range of behaviours intended to harm others. **agoraphobia**
a phobia that makes people avoid public places or situations in which escape might be difficult or help unavailable should panic symptoms develop.

agrammatism
a neurological condition arising from damage to a brain region just anterior to Broca's area, where the patient is incapable of using words in grammatical sequence.

alcoholism long-term pattern of alcohol addiction. **algorithm**
a problem-solving strategy that always leads to a solution. **allele** variation of a gene.

altered states of consciousness
a change in a person's ability to be fully aware of their external surroundings and internal states.

altruism self-sacrificing behaviour carried out for the benefit of others. **Alzheimer's disease**
most common form of dementia, usually beginning with mild memory problems, lapses of attention, and problems in language, and progressing to difficulty with even simple tasks and recall of long-held memories.

amnestic disorders organic disorders in which memory loss is the primary symptom.

amotivation the state of being without motivation. **amygdala**
brain area involved in processing information about emotions, particularly fear.

analogous
characteristics that are similar between species and that *cannot* be traced back to a common ancestor.

anorexia nervosa
eating disorder in which individuals under-eat and have a distorted body image of being overweight.

anosmia inability to detect odours. **anterograde amnesia**
ongoing inability to form new memories after an amnesia-inducing event. **antianxiety drugs** psychotropic drugs that reduce tension and anxiety. **antidepressant drugs**
psychotropic drugs that lift the mood of depressed people. **antipsychotic drugs**
medications that help remove the symptoms of schizophrenia. **antipsychotic drugs**
psychotropic drugs that help correct grossly confused or distorted thinking. **antisocial personality disorder**
a personality disorder characterized by extreme and callous disregard for the feelings and rights of others.

applied psychology

the branch of psychology applying psychological principles to practical problems in other fields, such as education, marketing, or industry.

approach–approach conflict
conflict that occurs when a person must choose between two equally desirable options.

approach–avoidance conflict
conflict that occurs when any available choice has both desirable and undesirable qualities.

approach motivation
the desire to experience a positive outcome following a behaviour. **assimilation**

one of two ways of acquiring knowledge, defined by Piaget as the inclusion of new information or experiences into pre-existing schemes.

association cortex
areas of the cortex responsible for complex functions, including higher-order sensory processing, thinking, and planning—all of cortex that is neither purely sensory nor motor.

associative learning learning that involves forming associations between stimuli.

attachment
a significant emotional connection to another person, such as a baby to a primary caregiver.

attitudes relatively stable and enduring evaluations of things and people. **attributions**

causal explanations of behaviour. **automatic processing**

encoding of information with little conscious awareness or effort. **automatic thoughts**

specific upsetting thoughts that arise unbidden. **autonomic nervous system**

portion of the peripheral nervous system that comprises the sympathetic and parasympathetic nervous systems.

availability heuristic judging easily-recalled events as more common. **aversion therapy**
therapy designed to help clients to acquire anxiety responses to stimuli that the clients have been finding too attractive.

avoidance–avoidance conflict
conflict that occurs when a person must choose between two equally undesirable options.

avoidance motivation
the desire to avoid the experience of a negative outcome following a behaviour. **axon terminal** the end of a neuron's axon, from which neurotransmitters are released. **axon**

the part of the neuron that carries information away from the cell body toward other neurons.

B

babbling babies' production of meaningless sounds. **basic emotions**

a group of emotions preprogrammed into all humans regardless of culture. **basilar**

membrane structure in the cochlea where the hair cells are located. **behavioural genetics** a subfield of psychology looking at the influence of genes on human behaviour.

behaviourism
a branch of psychological thought arguing that psychology should study only directly observable behaviours rather than abstract mental processes.

behaviourism the systematic study and manipulation of observable behaviour.

behaviour modification
a systematic approach to change behaviour using principles of operant conditioning.

behaviour
observable activities of an organism, often in response to environmental cues. **biases**
distorted beliefs based on a person's subjective sense of reality. **binge eating disorder**
out-of-control eating of an unusually large amount of food in a single event, often multiple times per week, over several months or years.

bioecological model of intelligence
Ceci's theory that intelligence is a function of the interactions among innate potential abilities, environmental context, and internal motivation.

biological therapy
the use of physical and chemical procedures to help people overcome psychological difficulties.

bipolar disorder
a mood disorder in which periods of mania alternate with periods of depression. **body mass index (BMI)** weight-to-height ratio. **body weight set point**
a weight that individuals typically return to even after dieting or overeating.

borderline personality disorder
a personality disorder characterized by severe instability in emotions and self-concept and high levels of volatility.

bottom-up processing
perception that proceeds by transducing environmental stimuli into neural impulses that move into successively more complex brain regions.

bounded rationality
the fact that in many situations, our ability to make clear rational decisions is limited or "bounded" by things like a lack of information, time constraints, or emotions attached to aspects of the problem we are trying to solve.

brain entropy
the number of neural states, or neural configurations, a brain can access during a task.

Broca's aphasia
a neurological condition arising from damage to Broca's area where the patient is unable to produce coherent speech.

Broca's area a brain region located in the frontal lobe important for speech production.

bulimia nervosa
eating disorder in which individuals binge and then engage in purging-type behaviour.

C

Cannon-Bard theory of emotion
a theory proposing that the subjective experience of emotion and the activation of the sympathetic nervous system (that is, bodily arousal) occur simultaneously.

case study study focusing on a single person. **catatonia**
extreme psychomotor symptoms of schizophrenia, including catatonic stupor, catatonic rigidity, and catatonic posturing.

catharsis
reliving of past repressed feelings as a means of settling internal conflicts and overcoming problems.

cellular clock theory
theory suggesting that we age because our cells have built-in limits on their ability to reproduce.

cephalocaudal pattern
a pattern in which growth and development proceed from top to bottom. **cerebellum**
the part of the brain, near the base of the back of the head, important for motor coordination.

cerebral cortex
the largest portion of the brain, responsible for complex behaviours including language and thought.

child-directed speech
speech characterized by exaggerated emotional responses and a slower pace that is cross-culturally common among caregivers communicating with babies and young children.

chromosomes
strands of DNA; each human being has chromosomes, distributed in pairs. **chronic stressor**
a stressful situation or circumstance that is more long term and often lacks a definite endpoint.

chunking
grouping bits of information together to enhance ability to hold that information in working memory.

circadian rhythm
pattern of sleep–wake cycles that in human beings roughly corresponds to periods of daylight and night.

classical conditioning
a form of associative learning between two previously unrelated stimuli that results in a learned response.

client-centred therapy
an approach to therapy founded by Carl Rogers, based on the notion that the client is an equal and that positive gains are made by mirroring clients' thoughts and feelings in an atmosphere of unconditional positive regard.

client-centred therapy
humanistic therapy designed to help clients experience unconditional positive regard and look at themselves honestly and acceptingly.

clinical and counselling psychology
the study of abnormal psychological behaviour and interventions designed to change that behaviour.

cochlea fluid-filled structure in the inner ear; contains the hair cells. **codominance**
what occurs when in a heterozygous combination of alleles, both traits are expressed in the offspring.

cognition mental processes of thinking and knowing. **cognitive control**
the ability to direct thought in accord with one's intentions. **cognitive development**
changes in thinking that occur over the course of time. **cognitive dissonance**
a state of emotional discomfort people experience when they hold two contradictory beliefs or hold a belief that contradicts their behaviour.

cognitive-mediational theory of emotion
a theory proposing that cognitive interpretations, particularly appraisals, of events are the keys to experiences of emotion.

cognitive neuroscience
the study of mental processes and how they relate to the biological functions of the brain.

cognitive psychology
the field of psychology studying mental processes as forms of information processing, or the ways in which information is stored and operated in our minds.

cognitive therapy
Beck's cognitive therapy technique designed to help clients recognize and change their dysfunctional thoughts and ways of thinking.

cognitive triad
a pattern of thinking in which individuals repeatedly interpret their experiences, themselves, and their futures in negative ways that lead them to feel depressed.

cohort-sequential design
blended cross-sectional and longitudinal research, designed to look at how individuals from different age groups compare to one another and to follow them over time.

collectivist
a culture whose members focus more on the needs of the group and less on individual desires.

common ancestor
an organism that is common to the evolutionary history of two or more living species.

community mental health treatment
treatment programs that emphasize community care, including an emphasis on prevention.

comorbidity

the condition in which a person's symptoms qualify him or her for two or more diagnoses.

compulsions
irrational repetitive and rigid behaviours or mental acts that people feel compelled to perform to prevent or reduce anxiety.

concentration gradient
the difference in concentration of sodium ions inside and outside of the neuron.

concrete operational stage
Piagetian stage during which children are able to talk about complex relationships, such as categorization and cause and effect, but are still limited to understanding ideas in terms of real-world relationships.

conditioned response (CR)
a physical response elicited by a conditioned stimulus; it is acquired through experience and is usually the same as the unconditioned response.

conditioned stimulus (CS)
a neutral stimulus that eventually elicits the same response as an unconditioned stimulus with which it has been paired.

conditioned taste aversion
a form of classical conditioning whereby a previously neutral stimulus (often an odour or taste) elicits an aversive reaction after it's paired with illness (nausea).

conditioning the association of events in the environment. **cones**

photoreceptors responsive to colours. **confirmation bias**

tendency to look for information that meets our expectations. **conflict**

discomfort brought about by two or more goals or impulses perceived to be incompatible.

conformity the tendency to yield to social pressure. **conscious motivations**

motivations that people are aware of and can verbalize. **consciousness**

our immediate awareness of our internal and external states. **consciousness**

personal awareness of ongoing mental processes, behaviours, and environmental events.

conservation
the understanding that certain properties of an object (such as volume and number) remain the same despite changes in the object's outward appearance.

contents of consciousness
specific thoughts we are aware of about our internal states or external surroundings.

content validity
the degree to which the content of a test accurately represents what the test is intended to measure.

context
the original location where you first learned a concept or idea, rich with retrieval cues that will make it more likely you will be able to recall that information later if you are in that same location or context.

continuous reinforcement
what occurs when behaviour is reinforced every time it occurs. **control group**
group that has not been or will not be exposed to the independent variable.

convergence inward movement of the eyes to view objects close to oneself.

convergent evolution
the development of similar physical characteristics or behaviours in different species that do not share a common ancestor; occurs because of exposure to similar environmental conditions for different species.

coping efforts to manage, reduce, or tolerate stress. **corpus callosum**
bundle of axons that allows communication from one side of the cortex to the other.

correlation coefficient
statistic expressing the strength and nature of a relationship between two variables.

correlation predictable relationship between two or more variables. **couple therapy or relationship counselling**
therapy format in which a therapist works with two people who are in a long-term relationship.

creativity the ability to produce ideas that are both original and valuable. **critical period**
a window of time in development during which certain influences are *necessary* for appropriate formation of the brain.

critical periods
points in development when an organism is extremely sensitive to environmental input, making it easier for the organism to acquire certain brain functions and behaviours.

cross-cultural psychology
the study of what is generally or universally true about human beings regardless of culture.

cross-sectional design
a research approach that compares groups of different-aged people to one another.

cultural psychology
the study of how cultural practices shape psychological and behavioural tendencies and influence human behaviour.

cultural universality behaviours and practices that occur across all cultures. **culture**
a set of shared beliefs and practices that are transmitted across generations. **culture-sensitive therapies**
approaches that seek to address the unique issues faced by members of cultural minority groups.

D

daily hassles
everyday annoyances that contribute to higher stress levels; also known as *micro-stressors*.

deafness loss or lack of hearing. **debriefing**

the supplying of full information to participants at the end of their participation in a research study.

decay theory

theory of forgetting, suggesting that memories fade over time due to neglect or failure to access over long periods of time.

decision making evaluating and choosing from among options. **deductive reasoning**

reasoning proceeding from broad basic principles applied to specific situations. **deep brain stimulation**

a procedure in which implanted electrodes deliver constant low stimulation to a small area of the brain; used to treat severe depression, Parkinson's disease, and epilepsy.

defence mechanisms

unconscious tactics employed by the ego to protect the individual from anxiety.

delusions blatantly false beliefs that are firmly held despite evidence to the contrary.

dementia

severe memory problems combined with losses in at least one other cognitive function, such as abstract thinking or language.

dendrites the parts of neurons that receive input from other neurons. **denial**

a defence mechanism; the process of refusing to recognize an existing situation.

deoxyribonucleic acid (DNA) molecules in which genetic information is enclosed.

dependent variable

condition or event that you expect to change as a result of variations in the independent variable.

depolarization

what occurs when the inside of the neuron membrane becomes *less* negative relative to the outside.

depressants class of drugs that slow the activity of the central nervous system.

depression

a persistent sad state in which life seems dark and its challenges overwhelming.

descriptive research methods

studies that allow researchers to demonstrate a relationship between the variables of interest, without specifying a causal relationship.

developmental psychology

the study of changes in behaviour and mental processes over time and the factors that influence the course of those constancies and changes.

developmental psychopathology

the study of how problem behaviours evolve as a function of a person's genes and early experiences, and how these early issues affect the person at later life stages.

diagnosis

a clinician's determination that a person's cluster of symptoms represents a particular disorder.

Diagnostic and Statistical Manual of Mental Disorders (DSM)
the leading classification system for psychological disorders in Canada; DSM-5 is the current version.

difference threshold or just noticeable difference
the minimal difference between two stimuli necessary for detection of a difference between the two.

discrete trait a trait that results as the product of a single gene pairing. **dishabituation**
a form of non-associative learning whereby there is a recovery of attention to a novel stimulus following habituation.

disorder of written expression
a disorder experienced as impairment in the ability to create the written word.

dissociation a splitting of consciousness into two dimensions. **dissociative disorder**
a psychological disorder characterized by major loss of memory without a clear physical cause; types include *dissociative amnesia*, *dissociative fugue*, and *dissociative identity disorder*.

distress stress caused by unpleasant situations or circumstances. **dominant trait**
a trait that is expressed in a phenotype, no matter whether the genotype is homozygous or heterozygous for the trait.

dopamine
neurotransmitter produced by neurons in the hind brain and involved in movement and reward mechanisms.

double-blind procedure
study in which neither the participant nor the researcher knows what treatment or procedure the participant is receiving.

Down syndrome
an inherited disorder, usually caused by the presence of extra chromosomal material on the twenty-first chromosome, that results in intellectual disability.

dysexecutive syndrome
impairments in the ability to control and direct mental activities.

E

efferent neurons
neurons that carry information out from the CNS to the muscles and glands. **effortful processing** encoding of information through careful attention and conscious effort. **ego**
according to psychoanalytic theory, the personality element that works to help satisfy the drives of the id while complying with the constraints placed on behaviour by the environment.

egocentrism
flaws in children's reasoning based on their inability to take another person's perspective.

electroconvulsive therapy (ECT)

use of electric shock to trigger a brain seizure in hopes of relieving abnormal functioning.

electrostatic pressure
the force that drives ions that are of a similar charge away from one another or attracts two ions of opposite charges toward each other.

emotional intelligence
an individual's ability to perceive, express, assimilate, and regulate emotion. **emotion**

an intrapersonal state that occurs in response to either an external or an internal event and typically involves a physiological component, a cognitive component, and a behavioural component.

emotion-focused coping
coping strategies focused on changing one's feelings about the stressor. **empirical**

able to be tested in objective ways. **empirically supported or evidence-based treatment movement**
movement to help clinicians become more familiar with and apply research findings concerning the effectiveness of particular treatments.

encoding
a basic activity of memory, involving the recording of information in our brain.

encoding specificity principle
a theoretical framework that asserts that memory retrieval is more efficient when the information available at retrieval is similar to the information available at the time of encoding.

endocrine system the system that controls levels of hormones throughout the body.

endorphins and enkephalins
chemicals that belong to a naturally occurring class of opiates that reduce pain in the nervous system.

epigenetic
changes in gene expression that are independent of the DNA sequence of the gene.

episodic memory a person's memory of personal events or episodes from his life.

equifinality
the idea that different children can start from different points and wind up at the same outcome.

equilibrium balance in a mental framework. **eustress**

the optimal level of stress needed to promote physical and psychological health.

evolution a process of change over time. **evolutionary psychology**

a field of study believing that the body and brain are products of evolution and that genetic inheritance plays an important role in shaping the complete range of thoughts and behaviours.

evolutionary psychology
field of study that examines how the process of evolution has shaped the body and brain via the interaction of our genes and the environment to produce our thoughts and behaviours.

evolution by natural selection
the differential likelihood between members of a species in their ability to survive and reproduce.

executive function
the brain's ability to control and manage the mental processing of information.

experimental group group that is exposed to the independent variable. **experiment**
controlled observation in which researchers manipulate the presence or amount of the independent variable to see what effect it has on the dependent variable.

explicit memory
memory that a person can consciously bring to mind, such as your middle name.

extinction
reduction of a conditioned response after repeated presentations of the conditioned stimulus alone.

extrinsic motivation
engaging in a behaviour due to the influence of factors outside ourselves.

F

facial efference sensory feedback from facial muscular activity. **facial-feedback theory of emotion**
a theory proposing that subjective experiences of emotion are influenced by sensory feedback from facial muscular activity, or facial efference.

factor analysis
a statistical method for determining whether certain items on a test correlate highly, thus forming a unified set, or cluster, of items.

family systems theory
a theory holding that each family has its own implicit rules, relationship structure, and communication patterns that shape the behaviour of the individual members.

family therapy
a format in which therapists meet with all members of a family to help the whole family to change.

fitness
the ability of an individual to successfully grow to maturity and have offspring that perpetuate the existence of the species that the individual belongs to.

five-factor model
an empirically derived trait model that proposes five major trait categories: agreeableness/disagreeableness, extroversion/introversion, neuroticism/stability, conscientiousness/irresponsibility, and openness to experience/unimaginativeness.

fixed interval schedule
a schedule of reinforcement that occurs every time a specific time period has elapsed.

fixed mindset
a belief that talent is innate and that skill in a particular area is not determined by hard work and effort.

fixed ratio schedule
a schedule of reinforcement that occurs after a specific number of responses.

flashbacks
recurrence of the sensory and emotional changes after the LSD has left the body.

flashbulb memories
detailed and near-permanent memories of an emotionally significant event, or of the circumstances surrounding the moment we learned about the event.

Flynn effect an observed rise in average IQ scores throughout the world over time.

forgetting the inability to recall information that was previously encoded into memory.

formal operational stage
Piaget's final stage of cognitive development when children achieve hypothetical deductive reasoning and the ability to think abstractly.

fossilize the geological process of turning biological material into stone. **fovea**
centre of the retina, containing only cones, where vision is most clear. **free association**
psychodynamic therapy technique of allowing clients to freely talk about whatever they want.

free nerve endings
sensory receptors that convert physical stimuli into touch, pressure, or pain impulses.

free-radical theory
theory suggesting we age because special negatively-charged oxygen molecules become more prevalent in our body as we get older, destabilizing cellular structures and causing the effects of aging.

frontal lobe
lobe of the cortex involved in many functions, including movement and speech production.

frustration an emotion people experience when thwarted in pursuit of a goal.

functional fixedness tendency to view objects as having only one function.

functionalism
a philosophical approach that considers how mental processes function to adapt to changing environments.

fundamental attribution error
the tendency to use dispositional attributions to explain the behaviour of other people.

G

gate control theory of pain
theory that certain patterns of neural activity can close a "gate" to keep pain information from travelling to parts of the brain where it is perceived.

gender-sensitive or feminist therapies
approaches that seek to address the unique pressures of being female. **general adaptation syndrome (GAS)**

a three-stage response to stress identified by Hans Selye; the stages are alarm, resistance, and exhaustion.

generalized anxiety disorder (GAD)
an anxiety disorder in which people feel excessive anxiety and worry under most circumstances.

genes basic building blocks of our biological inheritance. **genotype**

a person's genetic inheritance. **Gestalt psychology**

the field of psychology arguing that we have inborn tendencies to structure what we see in particular ways and to structure our perceptions into broad perceptual units.

***g* factor**
a theoretical general factor of intelligence underlying all distinct clusters of mental ability; part of Spearman's two-factor theory of intelligence.

glia the cells that, in addition to neurons, make up the nervous system. **grit**

long-term perseverance toward a goal. **group**

an organized, stable collection of individuals in which the members are aware of and influence one another and share a common identity.

group polarization
the intensification of an initial tendency of individual group members brought about by group discussion.

group therapy
psychotherapy format in which a therapist sees several clients at the same time.

groupthink
a form of faulty group decision making that occurs when group members strive for unanimity, and this goal overrides their motivation to realistically appraise alternative courses of action.

growth mindset
a belief that hard work and effort can improve a person's skill or talent in a particular area.

gustatory sense our sense of taste.

H

habituation
a form of non-associative learning whereby repeated presentation of a stimulus leads to a reduction in response.

habituation
the process of habituating, in which individuals pay less attention to a stimulus after it is presented to them over and over again.

hair cells sensory receptors that convert sound waves into neural impulses.

hallucinations
imagined sights, sounds, or other sensory events experienced as if they were real.

hallucinogens

substances that dramatically change one's state of awareness, causing powerful changes in sensory perception.

Hawthorne effect
what happens when people who are being observed in studies or at their workplace improve or change some of their behaviour simply because they are being watched or studied, not in response to an experimental manipulation.

hedonic principle
the principle that we avoid painful experiences and approach pleasurable experiences.

hemispheres two sides of the brain. **heritability coefficient**
a correlation coefficient used to indicate the contribution of heredity to some characteristic, such as intelligence.

heritability
the amount of a given trait that can be attributed to inherited genetic factors.

heterozygous having parents contribute two different alleles to offspring. **heuristic**
a shortcut thinking strategy. **higher order conditioning**
what occurs when a previously conditioned stimulus functions as if it were an unconditioned stimulus for further conditioning.

hindbrain
the part of the brain closest to the spinal cord that consists of the medulla, the pons, and the cerebellum; the reticular formation begins here and extends to the midbrain.

hippocampus brain region important for certain types of learning and memory.

homeostasis
a tendency of the body to maintain itself in a state of balance or equilibrium.

homologous
characteristics that are similar between species and that can be traced back to a common ancestor.

homozygous
having both parents contribute the same genetic material for a particular trait.

humanistic psychology
theory of psychology that sought to give greater prominence to special and unique features of human functioning.

hyperpolarization
what occurs when the inside of the neuron membrane becomes *more* negative relative to the outside.

hypnagogic state a pre-sleep period often characterized by vivid sensory phenomena.

hypnosis
a seemingly altered state of consciousness during which individuals can be directed to act or experience the world in unusual ways.

hyposmia reduced ability to detect odours. **hypothalamus**
brain structure important for motivation and control of the endocrine system.

hypothesis

a general statement about the way variables relate that is objectively falsifiable.

hypothetico-deductive reasoning
process of modern science where scientists begin with an educated guess, perhaps based on previous research, about how the world works, and then set about designing small controlled observations to support or invalidate that hypothesis.

I

id
according to psychoanalytic theory, the personality element representing basic instinctual drives, such as those related to eating, sleeping, sex, and comfort.

immune system
the body's system of organs, tissues, and cells that identify and destroy foreign invaders, such as bacteria and viruses, as well as cancer cells.

implicit attitude an attitude of which the person is unaware. **implicit learning**
the acquisition of information without awareness. **implicit memory**
memory that a person is not consciously aware of, such as learned motor behaviours, skills, and habits.

incentives external motives that indirectly indicate reward. **independent variable**
condition or event that is thought to be a factor in changing another condition or event.

individualistic
a culture that places the wants or desires of the person over the needs of the group.

individual therapy
psychotherapy format in which the therapist sees the client alone; the oldest of the modern formats.

inductive reasoning
reasoning process proceeding from small specific situations to more general truths.

information processing
the means by which information is stored and operates internally. **information-processing model**
view of memory suggesting that information moves among three memory stores during encoding, storage, and retrieval.

information-processing theory
a developmental theory focusing on how children learn, remember, organize, and use information from their environment.

information-processing theory
hypothesis that dreams are the mind's attempt to sort out and organize the day's experiences and to fix them in memory.

informed consent
what occurs when researchers give as much information as possible about the purpose, procedures, risks, and benefits of the study so that a participant can make an informed decision about whether or not to participate.

inoculation

exposing oneself to a relatively low level of stress in a controlled situation to improve later performance in a more stressful situation.

insight learning
a sudden realization of a solution to a problem or leap in understanding new concepts.

insomnia
sleep disorder characterized by a regular inability to fall asleep or stay asleep. **instincts**
inborn behavioural tendencies, activated by stimuli in our environments. **intellectual disability**
term describing individuals who display general intellectual functioning that is well below average and, at the same time, poor adaptive behaviour.

intelligence quotient (IQ)
Terman's measure of intelligence; the ratio of a child's mental age to her chronological age, multiplied by 100.

intelligence
the ability to learn, to meet the demands of the environment effectively, and to understand and control one's mental activities.

interactionism
a view emphasizing the relationship between a person's underlying personality traits and the reinforcing aspects of the situations in which they choose to put themselves.

interference theory
theory that forgetting is influenced by what happens to people before or after they take information in.

intermittent or partial reinforcement
a schedule of reinforcement where the behaviour is followed by reinforcement only some of the time.

International Classification of Diseases (ICD)
the system used by most countries to classify psychological disorders; published by the World Health Organization and currently in its 11th edition (ICD-10).

interneurons
neurons that typically have a short axon and serve as a relay between different classes of neurons; in the spinal cord, interneurons communicate with both sensory and motor neurons.

interpersonal circle
a two-dimensional personality trait model based on blends of dominance and nurturance.

intrinsic motivation
engaging in a behaviour simply for the satisfaction that is part of doing it. **introspection**
a method of psychological study involving careful evaluation of mental processes and how simple thoughts expand into complex ideas.

ion channels
pores in the cell membrane that can open and close to allow certain ions into and out of the cell.

J

James-Lange theory of emotion
a theory proposing that felt emotions result from physiological changes, rather than being their cause.

L

language a set of symbols used to communicate. **language comprehension**
the process of understanding spoken, written, or signed language. **language production** the structured and conventional expression of thoughts through words.

latent learning
a form of learning that is not expressed until there is a reward or incentive. **lateral hypothalamus (LH)**
a region of the hypothalamus important in signalling thirst and hunger. **law of effect**
a law that states that behaviours leading to rewards are more likely to occur again, while behaviours producing unpleasantness are less likely to occur again.

learned helplessness
a situation in which repeated exposure to inescapable punishment eventually produces a failure to make escape attempts.

learning a lasting change caused by experience. **leptin**
a protein produced by fat cells that is important for regulating the amount of food eaten over long periods of time.

lexical hypothesis
the idea that our language contains the important ways in which people can differ.

lexical meaning dictionary meaning of a word. **life changes**
shifts in life circumstances that require adjustment of some kind. **limbic system**
a group of interconnected brain structures that are associated with learning, memory, basic emotions, and drives.

linguistic relativity hypothesis
hypothesis suggesting that the vocabulary available for objects or concepts in a language influences how speakers of that language think about them.

lobotomy
surgical practice of cutting the connections between the frontal lobe and the lower centres of the brain.

longitudinal design
a research approach that follows the same people over a period of time by administering the same tasks or questionnaires and seeing how their responses change.

long-term memory
the memory system in which we hold all of the information we have previously gathered, available for retrieval and use in a new situation or task.

long-term potentiation (LTP)

a phenomenon where repeated stimulation of certain nerve cells in the brain greatly increases the likelihood that the cells will respond strongly to future stimulation.

loose associations or derailment
a common thought disorder of schizophrenia, characterized by rapid shifts from one topic to another.

loss aversion
a tendency to be motivated more strongly to avoid a loss rather than to achieve a gain, even if the potential loss and gain are of equal size.

lucid dreams
dreams in which sleepers fully recognize that they are dreaming, and occasionally actively guide the outcome of the dream.

lymphocytes
white blood cells that circulate through the body and destroy foreign invaders and cancer cells; important components of the immune system.

M

major depressive disorder
a disorder characterized by a depressed mood that is significantly disabling and is not caused by such factors as drugs or a general medical condition.

mania a persistent state of euphoria or frenzied energy. **mathematics disorder**
a deficit in mathematical ability, including the ability to do calculations, as well as the ability to understand mathematical word problems and mathematical concepts.

maturation the unfolding of development in a particular sequence and time frame.

mean arithmetic average of a set of scores. **mean**
the average score in a distribution. **median**
the score exactly in the middle of a distribution. **meditation**
technique designed to turn one's consciousness away from the outer world toward one's inner cues and awareness.

medulla
the part of the brain that controls basic bodily processes and regulates certain reflexes.

Meissner's corpuscles
sensory receptors that convert physical stimuli about sensory touch on the fingertips, lips, and palms.

memory the faculty for recalling past events and past learning. **memory consolidation**
process by which memories stabilize in the brain. **memory span**
maximum number of items that can be recalled in the correct order. **menopause**
series of changes in hormonal function occurring in women during their 50s, which lead to the end of the menstrual cycle and reproductive capabilities.

mental age
the intellectual age at which a person is functioning, as opposed to chronological age.

mental imagery picturing things in your mind. **mental processes**

activities of our brain when engaged in thinking, observing the environment, and using language.

mental set tendency to use problem-solving strategies that have worked in the past.

Merkel's discs
sensory receptors that convert information about light to moderate pressure on the skin.

metacognition the ability to understand and control one's mental activities.

metacognition thinking about one's own thoughts. **mirror neurons**
neurons fired when an animal or human performs an action or when they see another animal perform the same action.

miscarriage
discharge of the fetus from the uterus before it is able to function on its own.

mnemonic devices
techniques used to enhance the meaningfulness of information as a way of making them more memorable.

modelling what occurs when an observer learns from the behaviour of another. **mode**
the score that occurs most frequently in a distribution. **monocular cues**
visual clues about depth and distance that can be perceived using information from only one eye.

mood stabilizing drugs
psychotropic drugs that help stabilize the moods of people suffering from bipolar disorder.

morpheme the smallest units of a language that convey meaning. **motivation**
any internal process or condition that directs behaviour. **motive** a need or desire.

motor skills the ability to control bodily movements. **multifinality**
the idea that children can start from the same point and wind up at any number of different outcomes.

myelin
a fatty, white substance formed from glial cells that insulates the axons of many neurons.

myelination
development of fatty deposits on neurons that allow electric impulses to pass through neurons more efficiently.

N

narcolepsy sleep disorder marked by uncontrollable urge to fall asleep. **naturalistic observation**
study in which researchers directly observe people in a study behaving as they normally do.

natural reflex
an automatic involuntary response that typically occurs without learning. **negative**

correlation
relationship in which, on average, scores on one variable increase as scores on another variable decrease.

negative punishment
removal of a pleasant stimulus as a consequence of a behaviour to decrease the probability of the behaviour being repeated.

negative reinforcement
removal of an unpleasant stimulus after a response to increase the probability that the behaviour will reoccur.

negative symptoms
in the case of schizophrenia, symptoms that seem to reflect pathological deficits, including poverty of speech, flat affect, loss of volition, and social withdrawal.

nerve conduction velocity (NCV)
the speed with which electrical impulses are transmitted along nerve fibres and across synapses.

neural efficiency hypothesis
the hypothesis that bright individuals show lower brain activity than less bright individuals during tests of low to moderate cognitive difficulty.

neurofibrillary tangles
twisted protein fibres found within the cells of the hippocampus and certain other brain areas.

neuroimaging
techniques that allow for studying brain activity and structure by obtaining visual images in awake humans.

neuron a nerve cell. **neuroplasticity**
the brain's ability to create new neural pathways as a result of experience or following an injury.

neuroscience the study of the brain and the nervous system. **neurosis**
an abnormal behaviour pattern caused by unresolved conflicts between the id, ego, and superego.

neurotransmitter receptors
proteins in the membranes of neurons that bind to neurotransmitters.

neurotransmitters
specialized chemicals that travel across synapses to allow communication between neurons.

non-associative learning
learning that does not involve forming associations between stimuli. **non-REM sleep (NREM)** Stages 1 through 4 of normal sleep pattern. **non-verbal communication**
body language. **norepinephrine**
a neurotransmitter that is important for arousal and attention. **normal distribution**
a symmetrical, bell-shaped distribution in which most scores are in the middle, with smaller groups of equal size at either end.

norms social rules about how members of a society are expected to act. **nucleus accumbens** a brain area important for motivation and reward.

O

obedience the act of following direct commands, usually given by an authority figure.

obesity overweight characterized as a body mass index of over 30. **object permanence**
an infant's realization that objects continue to exist even when they are outside of immediate sensory awareness.

observational learning or social learning
learning that occurs without overt training in response to watching the behaviour of others, called models.

obsessions
persistent thoughts, ideas, impulses, or images that seem to invade a person's consciousness.

obsessive-compulsive disorder (OCD)
a mental disorder associated with abnormal anxiety-provoking thoughts that can lead to ritualistic behaviours.

obsessive-compulsive disorder (OCD)
a mental disorder associated with repeated, abnormal, anxiety-provoking thoughts and/or repeated rigid behaviours.

occipital lobe
lobe of the cortex at the back of the skull, important for processing very visual information.

odorants airborne chemicals that are detected as odours. **olfactory bulb**
the first region where olfactory information reaches the brain on its way from the nose.

olfactory receptor neurons
sensory receptor cells that convert chemical signals from odorants into neural impulses that travel to the brain.

olfactory sense our sense of smell. **operant or instrumental conditioning**
a form of associative learning whereby behaviour is modified depending on its consequences.

operationalize to develop a working definition of a variable that allows you to test it.

operations
Piagetian description of children's ability to hold an idea in their mind and mentally manipulate it.

opioids class of drugs derived from the sap of the opium poppy. **optic nerve**
the bundle of axons of ganglion cells that carries visual information from the eye to the brain.

ossicles
tiny bones in the ear called the maleus (*hammer*), incus (*anvil*), and stapes (*stirrup*).

oval window

a membrane separating the ossicles and the inner ear, deflection of which causes a wave to form in the cochlea.

overregularization
the process by which elementary school children over-apply newly-learned grammatical rules to improperly "correct" an irregular part of speech, such as a verb (e.g., "goed" instead of "went").

P

Pacinian corpuscles sensory receptors that respond to vibrations and heavy pressure.

panic attacks periodic, short bouts of panic. **panic disorder**
an anxiety disorder characterized by recurrent and unpredictable panic attacks that occur without apparent provocation.

papillae bumps on the tongue that contain clumps of taste buds. **parallel distributed-processing (PDP) (or connectionist) model**
theory of memory suggesting that information is represented in the brain as a pattern of activation across entire neural networks.

parasympathetic nervous system
the part of the autonomic nervous system that is active during restful times. **parietal lobe**
lobe of the cortex involved in processing information related to touch and complex visual information, particularly about locations.

perception the conscious recognition and identification of a sensory stimulus.

perceptual constancies
our top-down tendency to view objects as unchanging, despite shifts in the environmental stimuli we receive.

perceptual set readiness to interpret a certain stimulus in a certain way. **perfect correlation**
one in which two variables are exactly related, such that low, medium, and high scores on both variables are always exactly related.

personality disorder
an inflexible pattern of inner experience and outward behaviour that causes distress or difficulty with daily functioning.

personality inventory
a questionnaire designed to assess various aspects of personality. **personality**
the unique characteristics that account for enduring patterns of inner experience and outward behaviour.

personality trait model a mini-theory about the structure of personality traits.

personality traits
tendencies to behave in certain ways that remain relatively constant across situations.

phenotype the observable manifestation of a person's genetic inheritance. **phobia**
a persistent and unreasonable fear of a particular object, activity, or situation.

phoneme
the smallest unit of sound in a language; an individual sound such as ba, da, or ta.

phonology
the study of how individual sounds or phonemes are used to produce language.

photoreceptors the sensory receptor cells for vision, located in the retina. **phrenology**
a method of assessing a person's mental and moral qualities by studying the shape of the person's skull.

phylogeny the development of unique species over time. **pituitary gland**
brain structure that plays a central role in controlling the endocrine system. **placebo**
an inactive substance, such as a sugar pill or distilled water, that mimics a drug but has no active ingredients.

placenta a nutrient-rich structure that serves to feed the developing fetus. **polygenic trait** a trait that manifests as the result of the contributions of multiple genes. **pons**
uppermost or anterior (front) part of the brainstem that includes the locus coeruleus.

positive correlation
relationship in which, on average, scores on two variables increase together. **positive psychology**
an area of psychology focusing on positive experiences and healthy mental functioning.

positive punishment
presentation of an unpleasant consequence following a specific behaviour to decrease the probability of the behaviour being repeated.

positive reinforcement
presentation of a pleasant consequence following a behaviour to increase the probability that the behaviour will reoccur.

positive symptoms
in the case of schizophrenia, symptoms that seem to represent pathological excesses in behaviour, including delusions, disorganized thinking and speech, hallucinations, and inappropriate affect.

postsynaptic potentials
electrical events in postsynaptic neurons that occur when a neurotransmitter binds to one of its receptors.

posttraumatic stress disorder (PTSD)
an anxiety disorder experienced in response to a major traumatic event, characterized by lingering, persistent, frightening thoughts or memories of the traumatic events, along with anxiety, depression, and other symptoms.

posttraumatic stress disorder (PTSD)
an anxiety disorder in which fear and related symptoms continue to be experienced long after a traumatic event.

potentiation synchronous networks of cells firing together. **pragmatics**
the practical aspects of language usage, including speech pace, gesturing, and body language.

preconsciousness
level of awareness in which information can become readily available to consciousness if necessary.

predictive validity
the extent to which scores on a particular test successfully predict future performance on a measure related to the test.

prefrontal cortex
important brain structure located just behind the forehead and implicated in working memory.

prefrontal lobe
portion of the frontal cortex involved in higher-order thinking, such as memory, moral reasoning, and planning.

prejudice
negative and unjust feelings about individuals based on their inclusion in a particular group.

prenatal period the period of development from conception to birth. **preoperational stage**
according to Piaget, a developmental stage during which children begin to develop ideas of objects in the external world and the ability to work with them in their mind.

pressure an expectation or demand that someone act in a certain way. **primary appraisal**
appraisal of a stressor to determine how severe it is; the first stage in Richard Lazarus's description of how people experience stress.

primary mental abilities
seven distinct mental abilities identified by Thurstone as the basic components of intelligence.

primary punisher a stimulus that is naturally aversive to an organism. **primary reinforcer** a stimulus that has survival value and is therefore intrinsically rewarding.

primary sex characteristics
changes in body structure that occur during puberty that have to do specifically with the reproductive system, including the growth of the testes and the ovaries.

priming
activation of one piece of information, which in turn leads to activation of another piece, and ultimately to the retrieval of a specific memory.

proactive interference
competing information that is learned before the forgotten material, preventing its subsequent recall.

problem-focused coping
coping strategies focused on dealing directly with the stressor, such as by changing the stressor in some way.

problem solving determining how to reach a goal. **projective test**

a personality assessment device intended to tap a person's unconscious by presenting the person with an ambiguous stimulus and asking the person to interpret what the stimulus means.

prospective memory ability to remember content in the future. **proximodistal pattern**

a pattern in which growth and development proceed from the centre to the extremities.

psychoactive drugs

chemicals that affect awareness, behaviour, sensation, perception, or mood.

psychoanalytic theory

psychological theory that human mental processes are influenced by the competition between unconscious forces to come into awareness.

psychology the study of mental processes and behaviours. **psychometric approach**

an approach to defining intelligence that attempts to measure intelligence with carefully constructed psychological tests.

psychoneuroimmunology

an area of study focusing on links between stress, the immune system, and health.

psychosexual stages

according to psychoanalytic theory, stages in the development of personality; the stages —labelled oral, anal, phallic, latency, and genital—are primarily influenced by sexuality and aggression.

psychosis loss of contact with reality. **psychosurgery**

brain surgery often used in hopes of relieving abnormal functioning. **psychotherapy**

a treatment system in which a client and therapist use words and acts to overcome the client's psychological difficulties.

psychotropic drugs medications that act primarily on the brain. **puberty**

development of full sexual maturity during adolescence. **punishment**

an experience that produces a decrease in a particular behaviour.

R

random selection

identifying a sample in such a way that everyone in the population of interest has an equal chance of being involved in the study.

rapid eye movement sleep (REM)

stage of sleep associated with rapid and jagged brainwave patterns, increased heart rate, rapid and irregular breathing, rapid eye movements, and dreaming.

rational-emotive behavioural therapy

Ellis's therapy technique designed to help clients discover and change the irrational assumptions that govern their emotions, behaviours, and thinking.

reading disorder

a deficit in reading comprehension, written spelling, and word recognition. **recall tasks**

memory tasks in which people are asked to produce information using no or few retrieval cues.

recessive trait
a trait that is only expressed if a person carries the same two genetic alleles (e.g., is homozygous for the trait).

reciprocal socialization the transactional relationship between parent and child.

recognition tasks
memory tasks in which people are asked to identify whether or not they have seen a particular item before.

reflexes
programmed physical reactions to certain cues that do not require any conscious thought to perform.

rehearsal
conscious repetition of information in an attempt to make sure the information is encoded.

reinforcement
a learning process that increases the likelihood a given response will be repeated.

reinforcer an experience that produces an increase in a certain behaviour. **relational psychoanalytic therapy**
a school of psychodynamic therapy holding that therapists should work to form more equal relationships with clients.

relative refractory period
a brief period just after the absolute refractory period during which a neuron can fire only if it receives a stimulus stronger than its usual threshold level.

reliability the degree to which a test produces the same scores over time. **replication**
repeated testing of a hypothesis to ensure that the results you achieve in one experiment are not due to chance.

representations
what results when a person has the ability to understand symbols (such as words) and to think about objects and events as mental entities.

representativeness heuristic
the assumption that individuals share characteristics of the category of which they are a member.

repression
the most basic defence mechanism; the process of keeping unpleasant memories or thoughts buried deep within the unconscious mind.

research ethics board (REB)
research oversight group that evaluates research to protect the rights of participants in the study.

resilience
the ability to recover from or avoid the serious effects of negative circumstances.

resistance

practice in which clients encounter a block in their free associations or change the subject to avoid a potentially painful discussion.

response the way we react to stimuli. **resting potential**

the electrical charge of a neuron when it is at rest. **restorative theory of sleep**

theory that we sleep to allow the brain and body to restore certain depleted chemical resources and eliminate chemical wastes that have accumulated during the waking day.

reticular formation

a complex neural network extending from the hindbrain into the midbrain that plays a central role in regulating consciousness and arousal.

retina

a specialized sheet of nerve cells in the back of the eye containing the sensory receptors for vision.

retinal disparity the slight difference in images processed by the retinas of each eye.

retrieval

a basic activity of memory, involving recovery of information when we need it later.

retrieval cues

words, sights, or other stimuli that remind us of the information we need to retrieve from our memory.

retroactive interference

learning of new information that disrupts access to previously recalled information.

retrograde amnesia

inability to remember things that occurred before an organic event. **retrospective memory** ability to remember content from the past. **reward-deficiency syndrome**

theory that people might abuse drugs because their reward centre is not readily activated by usual life events.

reward learning pathway

brain circuitry that is important for learning about rewarding stimuli. **risk factors**

biological and environmental factors that contribute to problem outcomes. **rods**

photoreceptors most responsive to levels of light and dark. **Ruffini's end-organs**

sensory receptors that respond to heavy pressure and joint movement.

S

sample

the group of people studied in an experiment, used to stand in for an entire group of people.

scaffolding

developmental adjustments that adults make to give children the help that they need, but not so much that they fail to move forward.

Schachter and Singer's two-factor theory of emotion

a theory proposing that an emotional state is a function of both physiological arousal and cognition.

schemas
knowledge bases that we develop based on prior exposure to similar experiences or other knowledge bases.

scheme
Piaget's proposed mental structures or frameworks for understanding or thinking about the world.

schizophrenia
a mental disorder characterized by disorganized thoughts, lack of contact with reality, and sometimes auditory hallucinations.

schizophrenia
a mental disorder characterized by disorganized thoughts, lack of contact with reality, and sometimes hallucinations.

secondary appraisal
appraisal of one's personal resources and ability to cope with a stressor; the second stage in Richard Lazarus's description of how people experience stress.

secondary punisher
a stimulus that becomes aversive when associated with a primary punisher. **secondary reinforcer**
a neutral stimulus that becomes rewarding when associated with a primary reinforcer.

secondary sex characteristics
changes that occur during puberty and that differ according to gender, but aren't directly related to sex.

sedative-hypnotic drugs
class of drugs that produces feelings of relaxation and drowsiness. **self-actualization**
the need of humans to fulfill their full and special potential; the highest level of need in Maslow's hierarchy of needs.

self-concept
a pattern of self-perception that remains consistent over time and can be used to characterize an individual.

self-determination
instinctive feelings of competence, relatedness, and autonomy that give purpose to life.

self-help groups
groups consisting of people who have similar problems and come together to help and support one another without the direct leadership of a professional clinician.

self-perception theory
a theory suggesting that when people are uncertain of their attitudes, they infer what the attitudes are by observing their own behaviour.

self-serving bias
the tendency people have to attribute their successes to internal causes and their failures to external ones.

semantic code

cognitive representation of information or an event based on the meaning of the information.

semantic memory a person's memory of general knowledge of the world. **semantics** the study of how meaning in language is constructed of individual words and sentences.

senile plaques
sphere-shaped deposits of a protein known as beta-amyloid that form in the spaces between cells in the hippocampus, cerebral cortex, and certain other brain regions, as well as in some nearby blood vessels.

sensation the act of using our sensory systems to detect environmental stimuli.

sensitive period
a point in development during which the brain is more *susceptible* to influences.

sensitization
a form of non-associative learning whereby a strong stimulus results in an exaggerated response to the subsequent presentation of weaker stimuli.

sensory adaptation
the process whereby repeated stimulation of a sensory cell leads to a reduced response.

sensory memory
memory involving a detailed, brief sensory image or sound retained for a brief period of time.

sensory receptor cells
specialized cells that convert a specific form of environmental stimuli into neural impulses.

sensory transduction
the process of converting a specific form of environmental stimuli into neural impulses.

***s* factor**
a theoretical specific factor uniquely tied to a distinct mental ability or area of functioning; part of Spearman's two-factor theory of intelligence.

shaping
introducing new behaviour by reinforcing close approximations of the desired behaviour.

signal detection theory
Theory that the response to a signal in every situation depends on an individual's ability to differentiate between the signal and noise, and on their response criteria.

sleep apnea
sleep disorder characterized by repeatedly ceasing to breathe during the night, depriving the brain of oxygen and leading to frequent awakenings.

sleep spindles
bursts of brain activity lasting a second or two; occur during Stage 2 sleep. **social anxiety disorder**
an anxiety disorder in which people feel severe, persistent, and irrational fears of social or performance situations in which embarrassment may occur.

social cognition

the way in which people perceive and interpret themselves and others in their social world.

social facilitation an effect in which the presence of others enhances performance.

social identity theory
a theory that emphasizes social cognitive factors in the onset of prejudice. **social loafing**
a phenomenon in which people exert less effort on a collective task than they would on a comparable individual task; also known as free riding.

socially desirable responding
tailoring answers on personality inventories to try to create a good impression. **social neuroscience** the study of social functioning and how it is tied to brain activity. **social psychology**
an area of psychology that seeks to understand, explain, and predict how people's thoughts, feelings, and behaviours are influenced by the actual, imagined, or implied presence of others.

social role
a set of norms ascribed to a person's social position—expectations and duties associated with the individual's position in the family, at work, in the community, and in other settings.

social role theory
theory that gender differences occur because girls and boys develop different behaviours and skills based largely on differences in gender role expectations.

social skills training
behavioural therapy technique in which therapists serve as models and teachers to help clients acquire desired social behaviours.

sociobiologists
theorists who believe humans have a genetically innate concept of how social behaviour should be organized.

sodium-potassium pump
protein molecules in the membrane of cells that push out sodium ions and push in potassium ions.

somatic nervous system
all the peripheral nerves that transmit information about body sensation and movement to and from the central nervous system.

somatic symptom and related disorders
excessive thought, feelings, and behaviours related to somatic symptoms.

somatosensory strip
an area of the parietal cortex that processes tactile information coming from our body parts.

sound waves vibrations of the air in the frequency of hearing. **source misattribution**
remembering information, but not the source it came from; can lead to remembering information from unreliable sources as true.

spaced practice effect
facilitated encoding of material through rehearsal situations spread out over time.

spatial navigation learning
learning that involves forming associations among stimuli relevant to navigating in space.

specific learning disorder
a disorder that interferes with the acquisition and use of one or more of the basic psychological processes involved in the development of academic skills: oral language, reading, written language, and mathematics.

speech the expression of language through sounds. **spinal cord**
portion of the central nervous system that extends down from the base of the brain and mediates sensory and motor information.

spontaneous recovery
re-emergence of a conditioned response sometime after extinction has occurred. **stage**
a distinct developmental phase in which organisms behave, think, or respond in a particular way that is qualitatively different from the way they responded before.

standard deviation statistical index of how much scores vary within a group.

standardization the use of uniform procedures in administering and scoring a test.

state-dependent memory
memory retrieval facilitated by being in the same state of mind in which you encoded the memory in the first place.

states of consciousness
the level of awareness we have of our external surroundings and internal states.

stereotypes
fixed overgeneralized and oversimplified beliefs about a person or a group of people based on assumptions about the group.

stereotype vulnerability or threat
a phenomenon in which people in a particular group perform poorly because they fear that their performance will conform to a negative stereotype associated with that group.

stimulants substances that increase the activity of the central nervous system. **stimuli**
elements of the environment that trigger changes in our internal or external states.

stimulus discrimination
what occurs when an organism learns to emit a specific behaviour in the presence of a conditioned stimulus, but not in the presence of stimuli similar to the conditioned stimulus.

stimulus generalization
what occurs when stimuli similar to the original conditioned stimulus trigger the same conditioned response.

storage a basic activity of memory, involving retention of information for later use.

stressor a situation or circumstance that triggers the stress response. **stress**

state brought on by any situation that threatens or appears to threaten a person's sense of well-being, thus challenging the individual's ability to cope.

structuralism
a philosophical approach that studies the structure of conscious experience.

substantia nigra a brain region important in fluidity of movement and inhibiting movements.

superego
according to psychoanalytic theory, the personality element in charge of determining which impulses are acceptable to express openly and which are unacceptable; develops as we observe and internalize the behaviours of others in our culture.

superfactor
a fundamental dimension of personality made up of a related cluster of personality traits.

suprachiasmatic nucleus (SCN)
a small group of neurons in the hypothalamus responsible for coordinating the many rhythms of the body.

survey study in which researchers give participants a questionnaire or interview them.

sympathetic nervous system
the part of the autonomic nervous system that is activated under conditions of stress.

synapses
tiny spaces between the axon terminal of one neuron and the neuron through which chemical communication occurs.

synaptic pruning
developmental reduction of neuronal connections, allowing stronger connections to flourish.

synaptic vesicles
membrane-bound spheres in the axon terminals of neurons in which neurotransmitters are stored before their release.

syntax
the system for using words (semantics) and word order to conveymeaning (grammar).

systematic desensitization
a process used to condition extinction of phobias through gradual exposure to the feared object or situation.

T

taste buds
clusters of sensory receptor cells that convert chemical signals from food into neural impulses that travel to the brain.

telegraphic speech
speech that consists of minimalistic sentences; characterizes early toddlerhood and is the first evidence of sentence formation.

temperament

a biologically-based tendency to respond to certain situations in similar ways throughout a person's lifetime.

temporal lobe
part of the cortex important in processing sound, in speech comprehension, and in recognizing complex visual stimuli, such as faces.

teratogens any environmental agent that causes damage during gestation. **thalamus**
an area of the brain that serves, in part, as a relay station for incoming sensory information.

theories ideas about laws that govern phenomena. **theory of mind**
an awareness of one's own mental states and the mental states of others. **theory of multiple intelligences**
theory that there is no single, unified intelligence, but instead several independent intelligences arising from different portions of the brain.

therapy outcome studies research that looks at the effects of various treatments.

threshold
the point at which the magnitude or intensity of a stimulus initiates a neural impulse.

threshold
the point at which the relative influence of other neurons succeeds in causing a neuron to initiate an action potential.

token economy
operant conditioning therapy program in which participants receive tokens (that can be traded for rewards) when they display desired behaviours.

tolerance
mark of physical dependence on a drug, in which the person is required to take incrementally larger doses of the drug to achieve the same effect.

tonotopic map representation in the auditory cortex of different sound frequencies.

top-down processing
perception processes led by cognitive processes, such as memory or expectations.

transcranial magnetic stimulation (TMS)
a procedure in which an electromagnetic coil placed on or above a person's head sends a current into the prefrontal cortex; used to treat severe depression.

transduction
process that involves converting stimulus energy into neural impulses that can be interpreted by the brain.

transference
process through which clients come to act and feel toward the therapist as they did toward important figures in their childhood.

traumatic events unexpected events severe enough to create extreme disruptions.

treatment or therapy
systematic procedures designed to change abnormal behaviour into more normal behaviour.

trephining

prehistoric practice of chipping a hole in the skull as a treatment for various brain conditions.

triangular theory of love
a theory proposed by Robert Sternberg that love is composed of three elements: intimacy, passion, and commitment.

triarchic theory of intelligence
Sternberg's theory that intelligence is made up of three interacting components: internal, external, and experiential components.

tympanic membrane the ear drum. **Type A**
a personality type characterized by competitiveness, impatience, and anger and hostility.

Type B
a personality type that is less aggressive, more relaxed, and less hostile than Type A.

Type C
a personality type characterized by difficulty in expressing or acknowledging negative feelings.

Type D
a personality type characterized by negative affectivity such as worry or gloominess and social inhibition.

U

unconditional positive regard acceptance without terms or conditions.

unconditioned response (UR)
a physical response elicited by an unconditioned stimulus; it does not need to be learned.

unconditioned stimulus (US) a stimulus that on its own elicits a response.

unconscious
hypothesized repository of thoughts, feelings, and sensations outside human awareness, thought in some theories to have a strong bearing on human behaviour.

unconscious motivations
motivations that people are unaware of and cannot verbalize. **unconscious state**
state in which information is not easily accessible to conscious awareness.

V

vagus nerve stimulation
a procedure in which an implanted device sends electrical signals to the brain through the vagus nerve; used to treat severe depression.

validity coefficient
a correlation coefficient that measures validity by correlating a test score with some external criterion.

validity

the extent to which a test accurately measures or predicts what it is supposed to measure or predict.

variable condition, event, or situation that is studied in an experiment. **variable interval schedule**

a schedule of reinforcement that occurs after varying amounts of time. **variable ratio schedule**

a schedule of reinforcement that occurs when the number of responses required for reinforcement is unpredictable.

ventromedial region of the hypothalamus (VMH)

a region of the hypothalamus important in signalling satiety. **vicarious learning**

learning that occurs when an individual observes the consequences to another's actions and then chooses to duplicate the behaviour or refrain from doing so.

violation-of-expectation

an experimental approach capitalizing on infants' and toddlers' heightened reactions to an unexpected event.

voluntarism

a theory in which will is regarded as the ultimate agency in human behaviour; belief that much of behaviour is motivated and that attention is focused for an explicit purpose.

W

wear-and-tear theory theory suggesting we age because use of our body wears it out.

Wernicke's aphasia

a neurological condition associated with damage to Wernicke's area where a person cannot understand language.

Wernicke's area

a brain region located in the temporal lobe that is important for language comprehension.

Wernicke's area

an area of the temporal cortex important in helping us understand language.

withdrawal symptoms

unpleasant and sometimes dangerous side effects of reducing intake of a drug after a person has become addicted.

working memory a short-term memory store that can hold five to nine items at once.

Y

Yerkes-Dodson law

law stating that ideal performance on a task occurs when the arousal level is optimized to the difficulty level of the task.

Z

zone of proximal development

the gap between what a child could accomplish alone and what the child can accomplish with help from others.

zygote a single cell resulting from successful fertilization of the egg by sperm.

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