GERIANNE M. ALEXANDER

REVIEW OF GENERAL PSYCHOLOGY TRANSFERRED FROM APA TO SAGE

2019

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Contents

PERSONALITY AND PSYCHOLOGICAL DISORDERS

THERAPY AND PSYCHOPHARMACOLOGY

READING 1

History of Psychology

SOURCE

OpenStax. (2019). *Psychology.* OpenStax CNX. https://openstax.org/details/books/psychology

LEARNING OBJECTIVES

- Understand the importance of Wundt and James in the development of psychology.
- Appreciate Freud's influence on psychology.
- Understand the basic tenets of Gestalt psychology.
- Appreciate the important role that behaviorism played in psychology's history.
- Understand the basic tenets of humanism.
- Understand how the cognitive revolution shifted psychology's focus back to the mind.

KEY TERMS

behaviorism
functionalism
humanism
introspection
psychoanalytic theory
structuralism

Psychology is a relatively young science with its experimental roots in the nineteenth century, compared, for example, to human physiology, which dates much earlier. Anyone interested in exploring issues related to the mind generally did so in a philosophical context prior to the nineteenth century. Two men, working in the nineteenth century, are generally credited as being the founders of psychology as a science and academic discipline that was distinct from philosophy. Their names were Wilhelm Wundt and William James. This section will provide an overview of the shifts in paradigms that have influenced psychology from Wundt and James through today.

WUNDT AND STRUCTURALISM

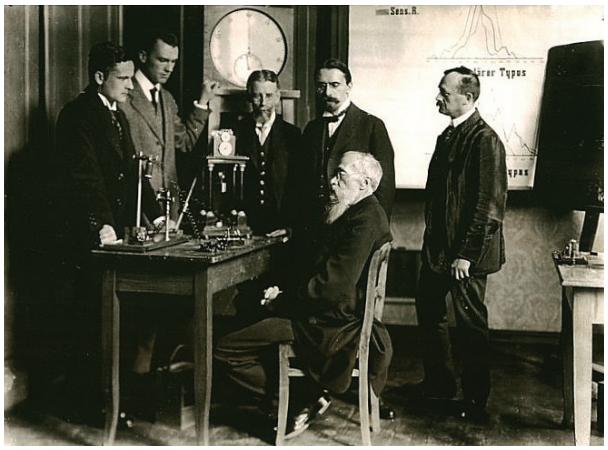
Wilhelm Wundt (1832–1920) was a German scientist who was the first person to be referred to as a psychologist. His famous book entitled *Principles of Physiological Psychology* was published in 1873. Wundt viewed psychology as a scientific study of conscious experience, and he believed that the goal of psychology was to identify components of consciousness and how those components combined to result in our conscious experience. Wundt used **introspection** (he called it "internal perception"), a process by which someone examines their own conscious experience as objectively as possible, making the human mind like any other aspect of nature that a scientist observed. Wundt's version of introspection used only very specific experimental conditions in which an external stimulus was designed to produce a scientifically observable (repeatable) experience of the mind (Danziger, 1980). The first stringent requirement was the use of "trained" or practiced observers, who could immediately observe and report a reaction. The second requirement was the use of repeatable stimuli that always produced the same experience in the subject and allowed the subject to expect and thus be fully attentive to the inner reaction. These experimental requirements were put in place to eliminate "interpretation" in the reporting of internal experiences and to counter the argument that there is no way to know that an individual is observing their mind or consciousness accurately, since it cannot be seen by any other person. This attempt to understand the structure or characteristics of the mind was known as **structuralism**. Wundt established his psychology laboratory at the University at Leipzig in 1879 (FIGURE 1.1). In this laboratory, Wundt and his students conducted experiments on, for example, reaction times. A subject, sometimes in a room isolated from the scientist, would receive a stimulus such as a light, image, or sound. The subject's reaction to the stimulus would be to push a button, and an apparatus would record the time to reaction. Wundt could measure reaction time to one-thousandth of a second (Nicolas & Ferrand, 1999).

However, despite his efforts to train individuals in the process of introspection, this process remained highly subjective, and there was very little agreement between individuals. As a result, structuralism fell out of favor with the passing of Wundt's student, Edward Titchener, in 1927 (Gordon, 1995).

JAMES AND FUNCTIONALISM

William James (1842–1910) was the first American psychologist who espoused a different perspective on how psychology should operate (FIGURE 1.2). James was introduced to Darwin's theory of evolution by natural selection and accepted it as an explanation of an organism's characteristics. Key to that theory is the idea that natural selection leads to

(a)



(b)

FIGURE 1.1. (a) Wilhelm Wundt is credited as one of the founders of psychology. He created the first laboratory for psychological research. (b) This photo (c. 1908) shows him seated, surrounded by fellow researchers and equipment in his laboratory in Germany. [(a) "Wilhelm Wundt. Photogravure by Synnberg Photo-gravure Co., 1898"/Wellcome Images is licensed under CC BY 4.0; (b) "Leipzig'te içgözlem denemeleri"/Wikimedia Commons is in the public domain.]

FIGURE 1.2. William James, shown here in a self-portrait, was the first American psychologist. ["William James self-portrait"/Wikimedia Commons is in the public domain.]

organisms that are adapted to their environment, including their behavior. Adaptation means that a trait of an organism has a function for the survival and reproduction of the individual, because it has been naturally selected. As James saw it, psychology's purpose was to study the function of behavior in the world, and as such, his perspective was known as **functionalism**. Functionalism focused on how mental activities helped an organism fit into its environment. Functionalism has a second, more subtle meaning in that functionalists were more interested in the operation of the whole mind rather than of its individual parts, which were the focus of structuralism. Like Wundt, James believed that introspection could serve as one means by which someone might study mental activities, but James also relied on more objective measures, including the use of various recording devices, and examinations of concrete products of mental activities and of anatomy and physiology (Gordon, 1995).

FREUD AND PSYCHOANALYTIC THEORY

Perhaps one of the most influential and well-known figures in psychology's history was Sigmund Freud (**FIGURE 1.3**). Freud (1856–1939) was an Austrian neurologist who was fascinated by patients suffering from "hysteria" and neurosis. Hysteria was an ancient diagnosis for disorders, primarily of women with a wide variety of symptoms, including physical symptoms and emotional disturbances, none of which had an apparent physical cause. Freud theorized that many of his patients' problems arose from the unconscious mind. In Freud's view, the unconscious mind was a repository of feelings and urges of which we have no awareness. Gaining access to the unconscious, then, was crucial to the successful resolution of the patient's problems. According to Freud, the unconscious mind could be accessed through dream analysis, by examinations of the first words that came to people's minds, and through seemingly innocent slips of the tongue. **Psychoanalytic theory** focuses on the role of a person's unconscious, as well as early childhood experiences, and this particular perspective dominated clinical psychology for several decades (Thorne & Henley, 2005).

Freud's ideas were influential, and you will learn more about them when you study lifespan development, personality, and therapy. For instance, many therapists believe strongly in the unconscious and the impact of early childhood experiences on the rest of a person's life. The method of psychoanalysis, which involves the patient talking about their experiences and selves, while not invented by Freud, was certainly popularized by him and is still used today. Many of Freud's

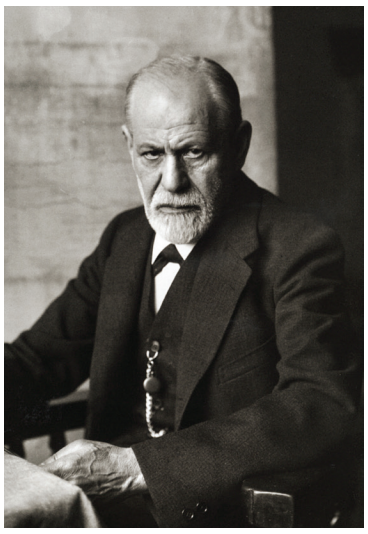


FIGURE 1.3. Sigmund Freud was a highly influential figure in the history of psychology. One of his many books, *A General Introduction to Psychoanalysis*, shared his ideas about psychoanalytical therapy; it was originally published in 1917. ["Sigmund Freud 1926" by Ferdinand Schmutzer/Wikimedia Commons is in the public domain.]

other ideas, however, are controversial. Drew Westen (1998) argues that many of the criticisms of Freud's ideas are misplaced, in that they attack his older ideas without taking into account later writings. Westen also argues that critics fail to consider the success of the broad ideas that Freud introduced or developed, such as the importance of childhood experiences in adult motivations, the role of unconscious versus conscious motivations in driving our behavior, the fact that motivations can cause conflicts that affect behavior, the effects of mental representations of ourselves and others in guiding our interactions, and the development of personality over time. Westen identifies subsequent research support for all of these ideas.

More modern iterations of Freud's clinical approach have been empirically demonstrated to be effective (Knekt et al., 2008; Shedler, 2010). Some current practices in psychotherapy involve examining unconscious aspects of the self and relationships, often through the relationship between the therapist and the client.

Freud's historical significance and contributions to clinical practice merit his inclusion in a discussion of the historical movements within psychology.

WERTHEIMER, KOFFKA, KOHLER, AND GESTALT PSYCHOLOGY

Max Wertheimer (1880–1943), Kurt Koffka (1886–1941), and Wolfgang Kohler (1887–1967) were three German psychologists who immigrated to the United States in the early twentieth century to escape Nazi Germany. These men are credited with introducing psychologists in the United States to various Gestalt principles. The word Gestalt roughly translates to "whole;" a major emphasis of Gestalt psychology deals with the fact that although a sensory experience can be broken down into individual parts, how those parts relate to each other as a whole is often what the individual responds to in perception. For example, a song may be made up of individual notes played by different instruments, but the real nature of the song is perceived in the combinations of these notes as they form the melody, rhythm, and harmony. In many ways, this particular perspective would have directly contradicted Wundt's ideas of structuralism (Thorne & Henley, 2005).

Unfortunately, in moving to the United States, these men were forced to abandon much of their work and were unable to continue to conduct research on a large scale. These factors along with the rise of behaviorism (described next) in the United States prevented principles of Gestalt psychology from being as influential in the United States as they had been in their native Germany (Thorne & Henley, 2005). Despite these issues, several Gestalt principles are still very influential today. Considering the human individual as a whole rather than as a sum of individually measured parts became an important foundation in humanistic theory late in the century. The ideas of Gestalt have continued to influence research on sensation and perception.

Structuralism, Freud, and the Gestalt psychologists were all concerned in one way or another with describing and understanding inner experience. But other researchers had concerns that inner experience could be a legitimate subject of scientific inquiry and chose instead to exclusively study behavior, the objectively observable outcome of mental processes.

PAVLOV, WATSON, SKINNER, AND BEHAVIORISM

Early work in the field of behavior was conducted by the Russian physiologist Ivan Pavlov (1849–1936). Pavlov studied a form of learning behavior called a conditioned reflex, in which an animal or human produced a reflex (unconscious) response to a stimulus and, over time, was conditioned to produce the response to a different stimulus that the experimenter associated with the original stimulus. The reflex Pavlov worked with was salivation in response to the presence of food. The salivation reflex could be elicited using a second stimulus, such as a specific sound, that was presented in association with the initial food stimulus several times. Once the response to the second stimulus was "learned," the food stimulus could be omitted. Pavlov's "classical conditioning" is only one form of learning behavior studied by behaviorists.

John B. Watson (1878–1958) was an influential American psychologist whose most famous work occurred during the early twentieth century at Johns Hopkins University (**FIGURE 1.4**). While Wundt and James were concerned with understanding conscious experience, Watson thought that the study of consciousness was flawed. Because he believed that objective analysis of the mind was impossible, Watson preferred to focus directly on observable behavior and try to bring that behavior under control. Watson was a major proponent of shifting the focus of psychology from the mind to behavior, and this approach of observing and controlling behavior came to be known as **behaviorism**. A major object of study by behaviorists was learned behavior and its interaction with

FIGURE 1.4. John B. Watson is known as the father of behaviorism within psychology. ["John Broadus Watson at Johns Hopkins c. 1908-1921"/Wikimedia Commons is in the public domain.]

inborn qualities of the organism. Behaviorism commonly used animals in experiments under the assumption that what was learned using animal models could, to some degree, be applied to human behavior. Indeed, Tolman (1938) stated, "I believe that everything important in psychology (except . . . such matters as involve society and words) can be investigated in essence through the continued experimental and theoretical analysis of the determiners of rat behavior at a choice-point in a maze."

Behaviorism dominated experimental psychology for several decades, and its influence can still be felt today (Thorne & Henley, 2005). Behaviorism is largely responsible for establishing psychology as a scientific discipline through its objective methods and especially experimentation. In addition, it is used in behavioral and cognitive-behavioral therapy. Behavior modification is commonly used in classroom settings. Behaviorism has also led to research on environmental influences on human behavior.

B. F. Skinner (1904–1990) was an American psychologist (**FIGURE 1.5**). Like Watson, Skinner was a behaviorist, and he concentrated on how behavior was affected by its consequences. Therefore, Skinner spoke of reinforcement and punishment as major factors in driving behavior. As a part of his research, Skinner developed a chamber that allowed the careful study of the principles of modifying behavior through reinforcement and punishment. This device, known as an operant conditioning chamber (or more familiarly, a Skinner box), has remained a crucial resource for researchers studying behavior (Thorne & Henley, 2005).

The Skinner box is a chamber that isolates the subject from the external environment and has a behavior indicator such as a lever or a button. When the animal pushes the button or lever, the box is able to deliver a positive reinforcement of the behavior (such as food) or a punishment (such as a noise) or a token conditioner (such as a light) that is correlated with either the positive reinforcement or punishment.

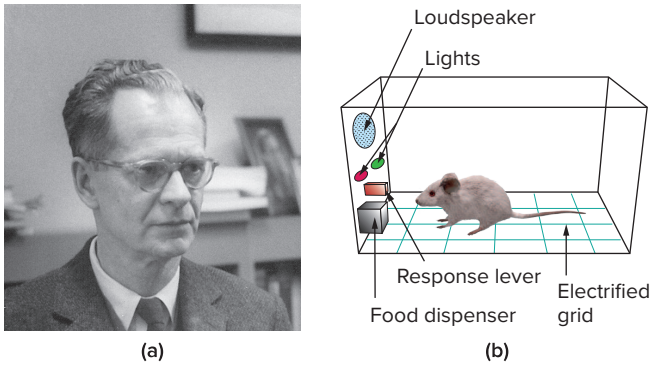


FIGURE 1.5. (a) B. F. Skinner is famous for his research on operant conditioning. (b) Modified versions of the operant conditioning chamber, or Skinner box, are still widely used in research settings today. [(a) "B.F. Skinner at Harvard circa 1950" by Silly rabbit/Wikimedia Commons is licensed under CC BY 3.0; (b) "Skinner Box" by Judy Schmitt is licensed under CC BY-NC-SA 4.0.]

Skinner's focus on positive and negative reinforcement of learned behaviors had a lasting influence in psychology that has waned somewhat since the growth of research in cognitive psychology. Despite this, conditioned learning is still used in human behavioral modification. Skinner's two widely read and controversial popular science books about the value of operant conditioning for creating happier lives remain as thought-provoking arguments for his approach (Greengrass, 2004).

MASLOW, ROGERS, AND HUMANISM

During the early twentieth century, American psychology was dominated by behaviorism and psychoanalysis. However, some psychologists were uncomfortable with what they viewed as limited perspectives being so influential to the field. They objected to the pessimism and determinism (all actions driven by the unconscious) of Freud. They also disliked the reductionism, or simplifying nature, of behaviorism. Behaviorism is also deterministic at its core, because it sees human behavior as entirely determined by a combination of genetics and environment. Some psychologists began to form their own ideas that emphasized personal control, intentionality, and a true predisposition for "good" as important for our self-concept and our behavior. Thus, humanism emerged. **Humanism** is a perspective within psychology that emphasizes the potential for good that is innate to all humans. Two of the most well-known proponents of humanistic psychology are Abraham Maslow and Carl Rogers (O'Hara, n.d.).

Abraham Maslow (1908–1970) was an American psychologist who is best known for proposing a hierarchy of human needs in motivating behavior (**FIGURE 1.6**). Although this concept will be discussed in more detail in a later chapter, a brief overview will be provided here. Maslow asserted that so long as basic needs necessary for survival were met (e.g., food, water, shelter), higher-level needs (e.g., social needs) would begin to motivate behavior. According to Maslow, the highest-level needs relate to self-actualization, a process by which we achieve our full potential. Obviously, the focus on the positive aspects of human nature that are characteristic of the humanistic perspective is evident (Thorne & Henley, 2005). Humanistic psychologists rejected, on principle, the research approach based on reductionist experimentation in the tradition of the physical and biological sciences, because it missed the "whole" human being. Beginning with Maslow and Rogers, there was an insistence on a humanistic research program. This program has been largely qualitative (not measurement-based), but there exist a number of quantitative research strains within humanistic psychology, including research on happiness, self-concept, meditation, and the outcomes of humanistic psychotherapy (Friedman, 2008).

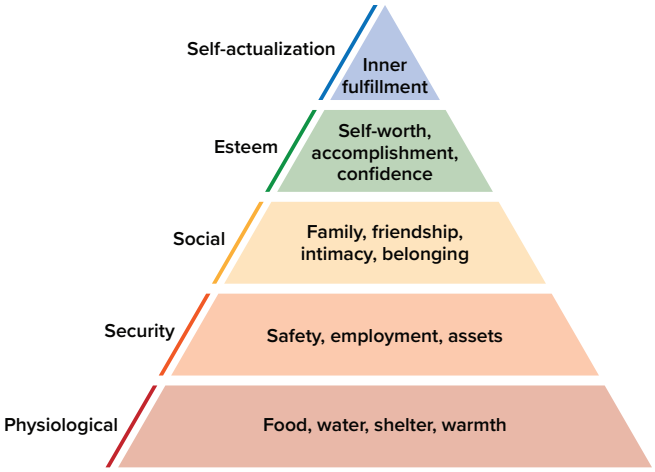


FIGURE 1.6. Maslow's hierarchy of needs. [This work, "Maslow's Hierarchy of Needs 2020," is licensed under CC BY-SA 4.0 by Judy Schmitt. It is a derivative of "Maslow's hierarchy of needs" by J. Finkelstein/Wikimedia Commons, which is licensed under CC BY-SA 3.0.]

Carl Rogers (1902–1987) was also an American psychologist who, like Maslow, emphasized the potential for good that exists within all people (**FIGURE 1.7**). Rogers used a therapeutic technique known as client-centered therapy in helping his clients deal with problematic issues that resulted in their seeking psychotherapy. Unlike a psychoanalytic approach in which the therapist plays an important role in interpreting what conscious behavior reveals about the unconscious mind, client-centered therapy involves the patient taking a lead role in the therapy session. Rogers believed that a therapist needed to display three features to maximize the effectiveness of this particular approach: unconditional positive regard, genuineness, and empathy. Unconditional positive regard refers to the fact that the therapist accepts their client for who they are, no matter what he or she might say. Provided these factors, Rogers believed that people were more than capable of dealing with and working through their own issues (Thorne & Henley, 2005).

Humanism has been influential to psychology as a whole. Both Maslow and Rogers are well-known names among students of psychology (you will read more about both men later in this text), and their ideas have influenced many scholars. Furthermore, Rogers' client-centered approach to therapy is still commonly used in psychotherapeutic settings today (O'Hara, n.d.)

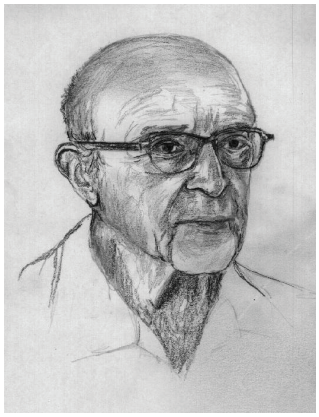


FIGURE 1.7. Carl Rogers, shown in this portrait, developed a client-centered therapy method that has been influential in clinical settings. ["Carl Ransom Rogers" by Didius/Wikimedia Commons is licensed under CC BY 2.5.]

LINK TO LEARNING

View a brief video of Carl Rogers describing his therapeutic approach.

THE COGNITIVE REVOLUTION

Behaviorism's emphasis on objectivity and focus on external behavior had pulled psychologists' attention away from the mind for a prolonged period of time. The early work of the humanistic psychologists redirected attention to the individual human as a whole, and as a conscious and self-aware being. By the 1950s, new disciplinary perspectives in linguistics, neuroscience, and computer science were emerging, and these areas revived interest in the mind as a focus of scientific inquiry. This particular perspective has come to be known as the cognitive revolution (Miller, 2003). By 1967, Ulric Neisser published the first textbook entitled *Cognitive Psychology*, which served as a core text in cognitive psychology courses around the country (Thorne & Henley, 2005).

Although no one person is entirely responsible for starting the cognitive revolution, Noam Chomsky was very influential in the early days of this movement (**FIGURE 1.8**). Chomsky (1928–), an American linguist, was dissatisfied with the influence that behaviorism had had on psychology. He believed that psychology's focus on behavior was short-sighted and that the field had to re-incorporate mental functioning into its purview if it were to offer any meaningful contributions to understanding behavior (Miller, 2003).

European psychology had never really been as influenced by behaviorism as had American psychology; and thus, the

FIGURE 1.8. Noam Chomsky was very influential in beginning the cognitive revolution. In 2010, this mural honoring him was put up in Philadelphia, Pennsylvania. ["Noam Chomsky mural" by Robert Moran/Flickr is licensed under CC BY 2.0.]

cognitive revolution helped reestablish lines of communication between European psychologists and their American counterparts. Furthermore, psychologists began to cooperate with scientists in other fields, like anthropology, linguistics, computer science, and neuroscience, among others. This interdisciplinary approach often was referred to as the cognitive sciences, and the influence and prominence of this particular perspective resonates in modern-day psychology (Miller, 2003).

MULTICULTURAL PSYCHOLOGY

Culture has important impacts on individuals and social psychology, yet the effects of culture on psychology are under-studied. There is a risk that psychological theories and data derived from white, American settings could be assumed to apply to individuals and social groups from other cultures and this is unlikely to be true (Betancourt & López, 1993). One weakness in the field of cross-cultural psychology is that in looking for differences in psychological attributes across cultures, there remains a need to go beyond simple descriptive statistics (Betancourt & López, 1993). In this sense, it has remained a descriptive science, rather than one seeking to determine cause and effect. For example, a study of characteristics of individuals seeking treatment for a binge eating disorder in Hispanic American, African American, and Caucasian American individuals found significant differences between groups (Franko et al., 2012). The study concluded that results from studying any one of the groups could not be extended to the other groups, and yet potential causes of the differences were not measured.

This history of multicultural psychology in the United States is a long one. The role of African American psychologists in researching the cultural differences between African American individual and social psychology is but one example. In 1920, Cecil Sumner was the first African American to receive a PhD in psychology in the United States. Sumner established a psychology degree program at Howard University, leading to the education of a new generation of African American psychologists (Black et al., 2004). Much of the work of early African American psychologists (and a general focus of much work in first half of the twentieth century in psychology in the United States) was dedicated to testing and intelligence testing in particular (Black et al., 2004). That emphasis has continued, particularly because of the importance of testing in determining opportunities for children, but other areas of exploration in African American psychology research include learning style, sense of community and belonging, and spiritualism (Black et al., 2004).

The American Psychological Association has several ethnically based organizations for professional psychologists that

DIG DEEPER

Feminist Psychology

The science of psychology has had an impact on human wellbeing, both positive and negative. The dominant influence of Western, white, and male academics in the early history of psychology meant that psychology developed with the biases inherent in those individuals, which often had negative consequences for members of society that were not white or male. Women, members of ethnic minorities in both the United States and other countries, and individuals with sexual orientations other than heterosexual had difficulties entering the field of psychology and therefore influencing its development. They also suffered from the attitudes of white, male psychologists, who were not immune to the nonscientific attitudes prevalent in the society in which they developed and worked. Until the 1960s, the science of psychology was largely a "womanless" psychology (Crawford & Marecek, 1989), meaning that few women were able to practice psychology, so they had little influence on what was studied. In addition, the experimental subjects of psychology were mostly men, which resulted from underlying assumptions that gender had no influence on psychology and that women were not of sufficient interest to study.

An article by Naomi Weisstein, first published in 1968 (Weisstein, 1993), stimulated a feminist revolution in psychology by presenting a critique of psychology as a science. She also specifically criticized male psychologists for constructing the psychology of women entirely out of their own cultural biases and without careful experimental tests to verify any of their characterizations of women. Weisstein used, as examples, statements by prominent psychologists in the 1960s, such as this quote by Bruno Bettleheim: "We must start with the realization that, as much as women want to be good scientists or engineers, they want first and foremost to be womanly companions of men and to be mothers." Weisstein's critique formed the foundation for the subsequent development of a feminist psychology that attempted to be free of the influence of male cultural biases on our knowledge of the psychology of women and, indeed, of both genders.

Crawford and Marecek (1989) identify several feminist approaches to psychology that can be described as feminist psychology. These include re-evaluating and discovering the contributions of women to the history of psychology, studying psychological gender differences, and questioning the male bias present across the practice of the scientific approach to knowledge. ■

facilitate interactions among members. Since psychologists belonging to specific ethnic groups or cultures have the most interest in studying the psychology of their communities, these organizations provide an opportunity for the growth of research on the impact of culture on individual and social psychology.

LINK TO LEARNING

Read a news story about the influence of an African American's psychology research on the historic *Brown v. Board of Education* civil rights case.

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READING 2

Contemporary Psychology

SOURCE

OpenStax. (2019). *Psychology.* OpenStax CNX. https://openstax.org/details/books/psychology

LEARNING OBJECTIVES

- Appreciate the diversity of interests and foci within psychology.
- Understand basic interests and applications in each of the described areas of psychology.
- Demonstrate familiarity with some of the major concepts or important figures in each of the described areas of psychology.

KEY TERMS

American Psychological Association (APA)
biopsychology
biopsychosocial model
clinical psychology
cognitive psychology
counseling psychology
developmental psychology
forensic psychology
personality psychology
personality traits
sport and exercise psychology

Contemporary psychology is a diverse field that is influenced by all of the historical perspectives described in the preceding section. Reflective of the discipline's diversity is the diversity seen within the **American Psychological Association (APA)**. The APA is a professional organization representing psychologists in the United States. The APA is the largest organization of psychologists in the world, and its mission is to advance and disseminate psychological knowledge for the betterment of people. There are 54 divisions within the APA, representing a wide variety of specialties that range from Societies for the Psychology of Religion and Spirituality to Exercise and Sport Psychology to Behavioral Neuroscience and Comparative Psychology. Reflecting the diversity of the field of psychology itself, members, affiliate members, and associate members span the spectrum from students to doctoral-level psychologists, and come from a variety of places including educational settings, criminal justice, hospitals, the armed forces, and industry (APA, 2020).

The Association for Psychological Science (APS) was founded in 1988 and seeks to advance the scientific orientation of psychology. Its founding resulted from disagreements between members of the scientific and clinical branches of psychology within the APA (Association for Psychological Science, n.d.). The APS publishes six research journals and engages in education and advocacy with funding agencies. A significant proportion of its members are international, although the majority is located in the United States. Other organizations provide networking and collaboration opportunities for professionals of several ethnic or racial groups working in psychology, such as the National Latina/o Psychological Association (NLPA), the Asian American Psychological Association (AAPA), the Association of Black Psychologists (ABPsi), and the Society of Indian Psychologists (SIP). Most of these groups are also dedicated to studying psychological and social issues within their specific communities.

This section will provide an overview of the major subdivisions within psychology today. This is not meant to be an exhaustive listing, but it will provide insight into the major areas of research and practice of modern-day psychologists.

LINK TO LEARNING

Please visit this website to learn about the divisions within the APA. Student resources are also provided by the APA.

BIOPSYCHOLOGY AND EVOLUTIONARY PSYCHOLOGY

As the name suggests, **biopsychology** explores how our biology influences our behavior. While biological psychology is a broad field, many biological psychologists want to understand how the structure and function of the nervous system is related to behavior (**FIGURE 2.1**). As such, they often combine the research strategies of both psychologists and physiologists to accomplish this goal (as discussed in Carlson, 2013).

The research interests of biological psychologists span a number of domains including, but not limited to, sensory and motor systems, sleep, drug use and abuse, ingestive behavior, reproductive behavior, neurodevelopment, plasticity of the nervous system, and biological correlates of psychological disorders. Given the broad areas of interest falling under the purview of biological psychology, it will probably come as

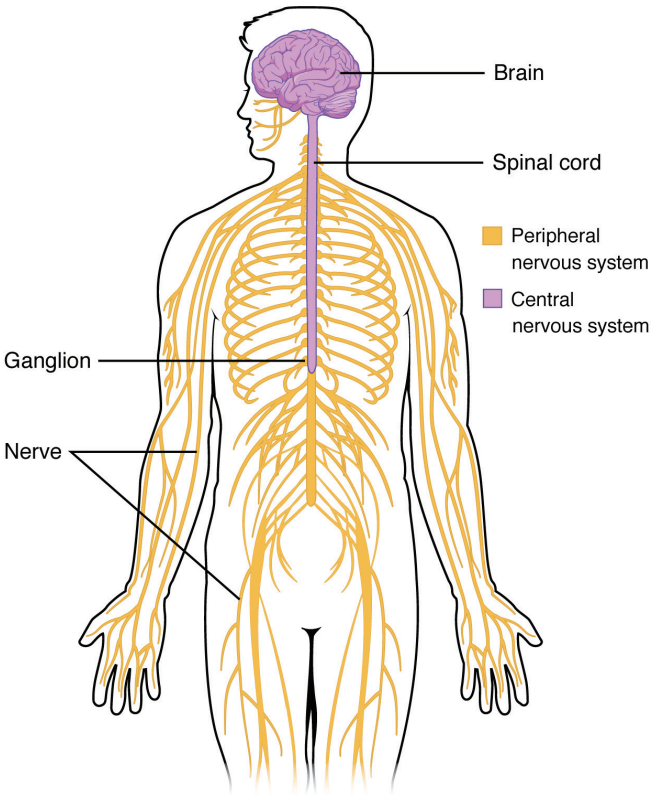


FIGURE 2.1. Biological psychologists study how the structure and function of the nervous system generate behavior. [This work, "Overview of Nervous System 2020," is licensed under CC BY-SA 4.0 by Judy Schmitt. It is a derivative of "Overview of Nervous System Revised" by Oregon State University/OpenStax, which is licensed under CC BY-SA 4.0.]

no surprise that individuals from all sorts of backgrounds are involved in this research, including biologists, medical professionals, physiologists, and chemists. This interdisciplinary approach is often referred to as neuroscience, of which biological psychology is a component (Carlson, 2013).

While biopsychology typically focuses on the immediate causes of behavior based in the physiology of a human or other animal, evolutionary psychology seeks to study the ultimate biological causes of behavior. To the extent that a behavior is impacted by genetics, a behavior, like any anatomical characteristic of a human or animal, will demonstrate adaption to its surroundings. These surroundings include the physical environment and, since interactions between organisms can be important to survival and reproduction, the social environment. The study of behavior in the context of evolution has its origins with Charles Darwin, the co-discoverer of the theory of evolution by natural selection. Darwin was well aware that behaviors should be adaptive and wrote books titled *The Descent of Man* (1871) and *The Expression of the Emotions in Man and Animals* (1872) to explore this field.

Evolutionary psychology—specifically, the evolutionary psychology of humans—has enjoyed a resurgence in recent decades. To be subject to evolution by natural selection, a behavior must have a significant genetic cause. In general, we expect all human cultures to express a behavior if it is caused genetically, since the genetic differences among human groups are small. The approach taken by most evolutionary psychologists is to predict the outcome of a behavior in a particular situation based on evolutionary theory and then to make observations, or conduct experiments, to determine whether the results match the theory. It is important to recognize that these types of studies are not strong evidence that a behavior is adaptive, since they lack information that the behavior is in some part genetic and not entirely cultural (Endler, 1986). Demonstrating that a trait, especially in humans, is naturally selected is extraordinarily difficult; perhaps for this reason, some evolutionary psychologists are content to assume the behaviors they study have genetic determinants (Confer et al., 2010).

One other drawback of evolutionary psychology is that the traits we possess now evolved under environmental and social conditions far back in human history, and we have a poor understanding of what these conditions were. This makes predictions about what is adaptive for a behavior difficult. Behavioral traits need not be adaptive under current conditions, only under the conditions of the past when they evolved, about which we can only hypothesize.

There are many areas of human behavior for which evolution can make predictions. Examples include memory, mate choice, relationships between kin, friendship and cooperation, parenting, social organization, and status (Confer et al., 2010).

Evolutionary psychologists have had success in finding experimental correspondence between observations and expectations. In one example, in a study of mate preference differences between men and women that spanned 37 cultures, Buss (1989) found that women valued earning potential factors greater than men, and men valued potential reproductive factors (youth and attractiveness) greater than women in their prospective mates. In general, the predictions were in line with the predictions of evolution, although there were deviations in some cultures.

SENSATION AND PERCEPTION

Scientists interested in both the physiological aspects of sensory systems and the psychological experience of sensory information work within the area of sensation and perception (**FIGURE 2.2**). As such, sensation and perception research is also quite interdisciplinary. Imagine walking between buildings as you move from one class to another. You are inundated with sights, sounds, touch sensations, and smells. You also experience the temperature of the air around you and maintain your balance as you make your way. These are all

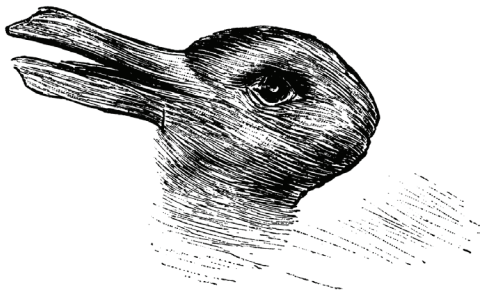


FIGURE 2.2. When you look at this image, you may see a duck or a rabbit. The sensory information remains the same, but your perception can vary dramatically. ["Kaninchen und Ente"/Wikimedia Commons is in the public domain.]

factors of interest to someone working in the domain of sensation and perception.

Our experience of our world is not as simple as the sum total of all of the sensory information (or sensations) together. Rather, our experience (or perception) is complex and is influenced by where we focus our attention, our previous experiences, and even our cultural backgrounds.

COGNITIVE PSYCHOLOGY

As mentioned in the previous section, the cognitive revolution created an impetus for psychologists to focus their attention on better understanding the mind and mental processes that underlie behavior. Thus, **cognitive psychology** is the area of psychology that focuses on studying cognitions, or thoughts, and their relationship to our experiences and our actions. Like biological psychology, cognitive psychology is broad in its scope and often involves collaborations among people from a diverse range of disciplinary backgrounds. This has led some to coin the term *cognitive science* to describe the interdisciplinary nature of this area of research (Miller, 2003).

Cognitive psychologists have research interests that span a spectrum of topics, ranging from attention to problem solving to language to memory. The approaches used in studying these topics are equally diverse.

Given such diversity, various concepts related to cognitive psychology will be covered in relevant portions of the chapters in this text on sensation and perception, thinking and intelligence, memory, lifespan development, social psychology, and therapy.

LINK TO LEARNING

View a brief video recapping some of the major concepts explored by cognitive psychologists.

DEVELOPMENTAL PSYCHOLOGY

Developmental psychology is the scientific study of development across a lifespan. Developmental psychologists are interested in processes related to physical maturation. However, their focus is not limited to the physical changes associated with aging, as they also focus on changes in cognitive skills, moral reasoning, social behavior, and other psychological attributes.

FIGURE 2.3. Jean Piaget is famous for his theories regarding changes in cognitive ability that occur as we move from infancy to adulthood. ["Jean Piaget in Ann Arbor"/Wikimedia Commons is in the public domain.]

Early developmental psychologists focused primarily on changes that occurred through reaching adulthood, providing enormous insight into the differences in physical, cognitive, and social capacities that exist between very young children and adults. For instance, research by Jean Piaget (**FIGURE 2.3**) demonstrated that very young children do not demonstrate object permanence. Object permanence refers to the understanding that physical things continue to exist, even if they are hidden from us. If you were to show an adult a toy, and then hide it behind a curtain, the adult knows that the toy still exists. However, very young infants act as if a hidden object no longer exists. The age at which object permanence is achieved is somewhat controversial (Munakata et al., 1997).

While Piaget was focused on cognitive changes during infancy and childhood as we move to adulthood, there is an increasing interest in extending research into the changes that occur much later in life. This may be reflective of changing population demographics of developed nations as a whole. As more and more people live longer lives, the number of people of advanced age will continue to increase. Indeed, it is estimated that there were just over 49 million people aged 65 or older living in the United States in 2016 (Roberts et al., 2018). However, by 2030—the year the last of the baby boomers has reached age 65—this number is expected to increase to about 73 million. By the year 2050, it is estimated that nearly 86 million people in this country will be 65 or older (U.S. Census Bureau, 2017).

PERSONALITY PSYCHOLOGY

Personality psychology focuses on patterns of thoughts and behaviors that make each individual unique. Several individuals (e.g., Freud and Maslow) that we have already discussed in our historical overview of psychology, as well as the American psychologist Gordon Allport, contributed to early theories of personality. These early theorists attempted to explain how an

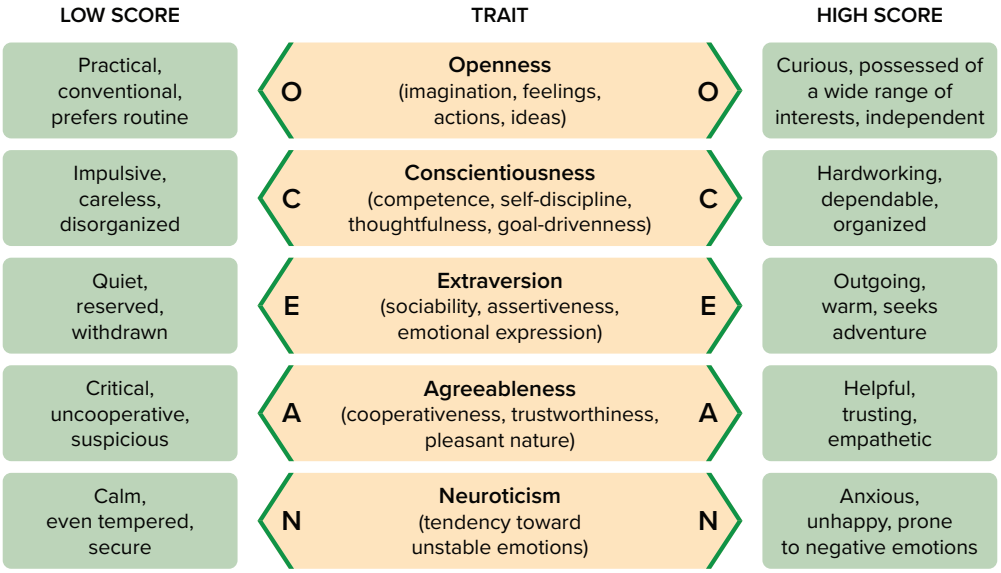


FIGURE 2.4. The dimensions of the Five-Factor model. The provided description would describe someone who scored highly on that given dimension. Someone with a lower score on a given dimension could be described in opposite terms. [This work, "Dimensions of Five-Factor Model," is licensed under CC BY-SA 4.0 by Judy Schmitt. It is a derivative of "Figure 1.14"/OpenStax, which is licensed under CC BY 4.0.]

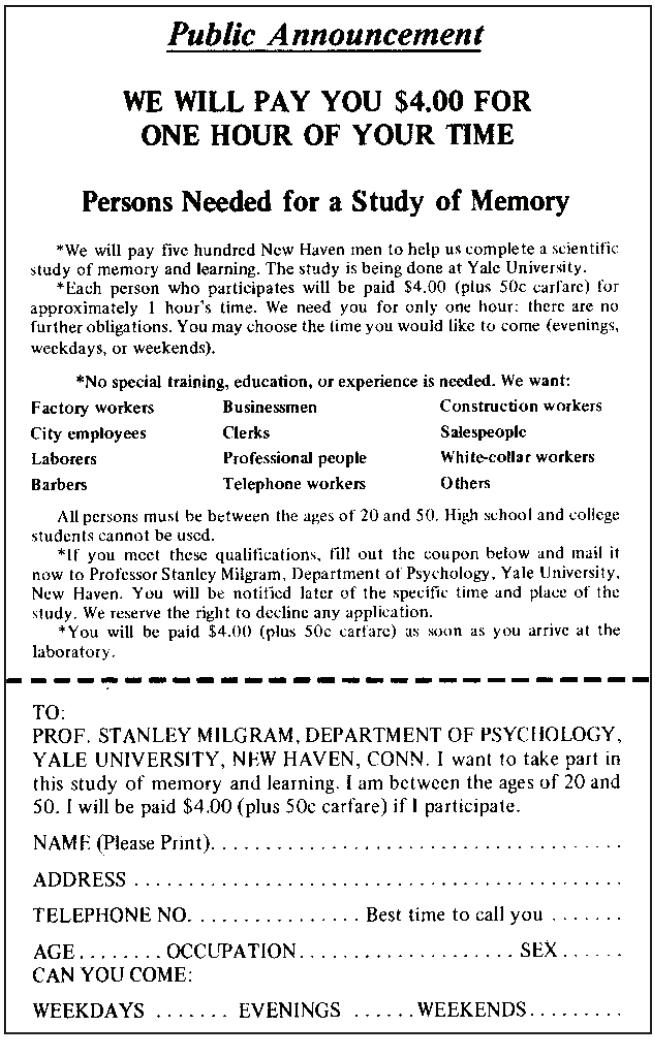
individual's personality develops from his or her given perspective. For example, Freud proposed that personality arose as conflicts between the conscious and unconscious parts of the mind were carried out over the lifespan. Specifically, Freud theorized that an individual went through various psychosexual stages of development. According to Freud, adult personality would result from the resolution of various conflicts that centered on the migration of erogenous (or sexual pleasure–producing) zones from the oral (mouth) to the anal to the phallic to the genital. Like many of Freud's theories, this particular idea was controversial and did not lend itself to experimental tests (Person, 1980).

More recently, the study of personality has taken on a more quantitative approach. Rather than explaining how personality arises, research is focused on identifying **personality traits**, measuring these traits, and determining how these traits interact in a particular context to determine how a person will behave in any given situation. Personality traits are relatively consistent patterns of thought and behavior, and many have proposed that five trait dimensions are sufficient to capture the variations in personality seen across individuals. These five dimensions are known as the "Big Five" or the Five-Factor model, and include dimensions of openness, conscientiousness, extraversion, agreeableness, and neuroticism (OCEAN) (**FIGURE 2.4**). Each of these traits has been demonstrated to be relatively stable over the lifespan (e.g., McCrae & Costa, 2008; Rantanen et al., 2007; Soldz & Vaillant, 1999) and is influenced by genetics (e.g., Jang et al., 1996).

SOCIAL PSYCHOLOGY

Social psychology focuses on how we interact with and relate to others. Social psychologists conduct research on a wide variety of topics that include differences in how we explain our own behavior versus how we explain the behaviors of others, prejudice, and attraction, and how we resolve interpersonal conflicts. Social psychologists have also sought to determine how being among other people changes our own behavior and patterns of thinking.

There are many interesting examples of social psychological research, and you will read about many of these in a later chapter of this textbook. Until then, you will be introduced to one of the most controversial psychological studies ever conducted. Stanley Milgram was an American social psychologist who is most famous for research that he conducted on obedience. After the holocaust, in 1961, a Nazi war criminal, Adolf Eichmann, who was accused of committing mass atrocities, was put on trial. Many people wondered how German soldiers were capable of torturing prisoners in concentration camps, and they were unsatisfied with the excuses given by soldiers that they were simply following orders. At the time, most psychologists agreed that few people would be willing to inflict such extraordinary pain and suffering, simply because they were obeying orders. Milgram decided to conduct research to determine whether or not this was true (**FIGURE 2.5**). As you will read later in the text, Milgram found that nearly two-thirds of his participants were willing to deliver what they believed to be lethal shocks to another person, simply because they were instructed to do so by an authority



Public Announcement

WE WILL PAY YOU $4.00 FOR ONE HOUR OF YOUR TIME

Persons Needed for a Study of Memory

*We will pay five hundred New Haven men to help us complete a scientific study of memory and learning. The study is being done at Yale University.

*Each person who participates will be paid $4.00 (plus 50c carfare) for approximately 1 hour's time. We need you for only one hour: there are no further obligations. You may choose the time you would like to come (evenings, weekdays, or weekends).

*No special training, education, or experience is needed. We want:

Factory workers	Businessmen	Construction workers
City employees	Clerks	Salespeople
Laborers	Professional people	White-collar workers
Barbers	Telephone workers	Others

All persons must be between the ages of 20 and 50. High school and college students cannot be used.

*If you meet these qualifications, fill out the coupon below and mail it now to Professor Stanley Milgram, Department of Psychology, Yale University, New Haven. You will be notified later of the specific time and place of the study. We reserve the right to decline any application.

*You will be paid $4.00 (plus 50c carfare) as soon as you arrive at the laboratory.

TO:
PROF. STANLEY MILGRAM, DEPARTMENT OF PSYCHOLOGY, YALE UNIVERSITY, NEW HAVEN, CONN. I want to take part in this study of memory and learning. I am between the ages of 20 and 50. I will be paid $4.00 (plus 50c carfare) if I participate.

NAME (Please Print). . . . . .

ADDRESS . . . . . .

TELEPHONE NO. . . . . Best time to call you . . . . . .

AGE . . . . . OCCUPATION . . . . . SEX . . . . . .
CAN YOU COME:

WEEKDAYS . . . . . EVENINGS . . . . . WEEKENDS . . . . . .

FIGURE 2.5. Stanley Milgram's research demonstrated just how far people will go in obeying orders from an authority figure. This advertisement was used to recruit subjects for his research. ["Milgram Experiment advertising"/Wikimedia Commons is in the public domain.]

figure (in this case, a man dressed in a lab coat). This was in spite of the fact that participants received payment for simply showing up for the research study and could have chosen not to inflict pain or more serious consequences on another person by withdrawing from the study. No one was actually hurt or harmed in any way; Milgram's experiment was a clever ruse that took advantage of research confederates, those who pretend to be participants in a research study who are actually working for the researcher and have clear, specific directions on how to behave during the research study (Hock, 2009). Milgram's and others' studies that involved deception and potential emotional harm to study participants catalyzed the development of ethical guidelines for conducting psychological research that discourage the use of deception of research subjects, unless it can be argued not to cause harm and, in general, requiring informed consent of participants.

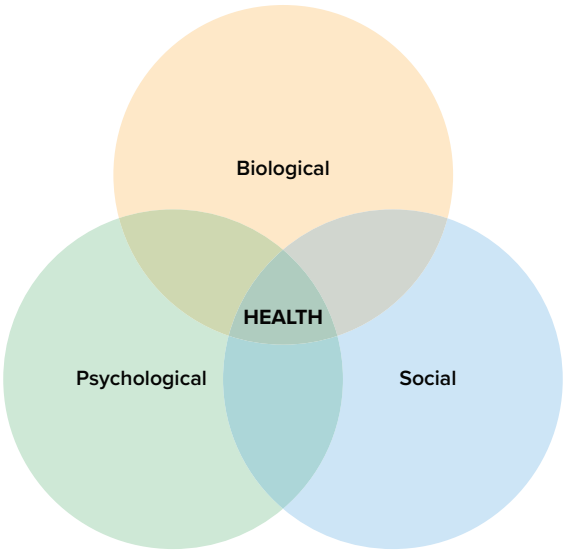


FIGURE 2.6. The biopsychosocial model suggests that health/illness is determined by an interaction of these three factors. ["Biopsychosocial Model of Health" by Judy Schmitt is licensed under CC BY-SA 4.0.]

INDUSTRIAL-ORGANIZATIONAL PSYCHOLOGY

Industrial-Organizational psychology (I-O psychology) is a subfield of psychology that applies psychological theories, principles, and research findings in industrial and organizational settings. I-O psychologists are often involved in issues related to personnel management, organizational structure, and workplace environment. Businesses often seek the aid of I-O psychologists to make the best hiring decisions as well as to create an environment that results in high levels of employee productivity and efficiency. In addition to its applied nature, I-O psychology also involves conducting scientific research on behavior within I-O settings (Riggio, 2013).

HEALTH PSYCHOLOGY

Health psychology focuses on how health is affected by the interaction of biological, psychological, and sociocultural factors. This particular approach is known as the **biopsychosocial model** (FIGURE 2.6). Health psychologists are interested in helping individuals achieve better health through public policy, education, intervention, and research. Health psychologists might conduct research that explores the relationship between one's genetic makeup, patterns of behavior, relationships, psychological stress, and health. They may research effective ways to motivate people to address patterns of behavior that contribute to poorer health (MacDonald, 2013).

SPORT AND EXERCISE PSYCHOLOGY

Researchers in **sport and exercise psychology** study the psychological aspects of sport performance, including motivation

and performance anxiety, and the effects of sport on mental and emotional wellbeing. Research is also conducted on similar topics as they relate to physical exercise in general. The discipline includes topics that are broader than sport and exercise but that are related to interactions between mental and physical performance under demanding conditions, such as fire fighting, military operations, artistic performance, and surgery (APA, 2014).

CLINICAL PSYCHOLOGY

Clinical psychology is the area of psychology that focuses on the diagnosis and treatment of psychological disorders and other problematic patterns of behavior. As such, it is generally considered to be a more applied area within psychology; however, some clinicians are also actively engaged in scientific research. **Counseling psychology** is a similar discipline that focuses on emotional, social, vocational, and health-related outcomes in individuals who are considered psychologically healthy.

As mentioned earlier, both Freud and Rogers provided perspectives that have been influential in shaping how clinicians interact with people seeking psychotherapy. While aspects of the psychoanalytic theory are still found among some of today's therapists who are trained from a psychodynamic perspective, Rogers's ideas about client-centered therapy have been especially influential in shaping how many clinicians operate. Furthermore, both behaviorism and the cognitive revolution have shaped clinical practice in the forms of behavioral therapy, cognitive therapy, and cognitive-behavioral therapy (**FIGURE 2.7**). Issues related to the diagnosis and treatment of psychological disorders and problematic patterns of behavior will be discussed in detail in later chapters of this textbook.

By far, this is the area of psychology that receives the most attention in popular media, and many people mistakenly assume that all psychology is clinical psychology.

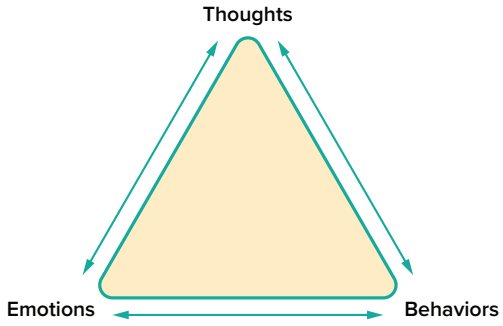


FIGURE 2.7. Cognitive-behavioral therapists take cognitive processes and behaviors into account when providing psychotherapy. This is one of several strategies that may be used by practicing clinical psychologists. [This work, "Thoughts-Emotions-Behaviors," is licensed under CC BY-SA 4.0 by Judy Schmitt. It is a derivative of "Figure 1.17"/OpenStax, which is licensed under CC BY 4.0.]

FORENSIC PSYCHOLOGY

Forensic psychology is a branch of psychology that deals with questions of psychology as they arise in the context of the justice system. For example, forensic psychologists (and forensic psychiatrists) will assess a person's competency to stand trial, assess the state of mind of a defendant, act as consultants on child custody cases, consult on sentencing and treatment recommendations, and advise on issues such as eyewitness testimony and children's testimony (American Board of Forensic Psychology, 2014). In these capacities, they will typically act as expert witnesses, called by either side in a court case to provide their research- or experience-based opinions. As expert witnesses, forensic psychologists must have a good understanding of the law and provide information in the context of the legal system rather than just within the realm of psychology. Forensic psychologists are also used in the jury selection process and witness preparation. They may also be involved in providing psychological treatment within the criminal justice system. Criminal profilers are a relatively small proportion of psychologists that act as consultants to law enforcement.

LINK TO LEARNING

The APA provides career information about various areas of psychology.

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READING 3

Overview of the Scientific Method

SOURCE

Jhangiani, R. S., Chiang, I-C. A., Cuttler, C., & Leighton, D. C. (2019). *Research methods in psychology* (4th ed.). Kwantlen Polytechnic University. https://kpu.pressbooks.pub/psychmethods4e/

LEARNING OBJECTIVES

- Review a general model of scientific research in psychology.
- Learn some common sources of research ideas.
- Define the research literature in psychology and give examples of sources that are part of the research literature and sources that are not.
- Describe and use several methods for finding previous research on a particular research idea or question.
- Describe some techniques for turning research ideas into empirical research questions and use those techniques to generate questions.
- Explain what makes a research question interesting and evaluate research questions in terms of their interestingness.
- Distinguish between a theory and a hypothesis.
- Discover how theories are used to generate hypotheses and how the results of studies can be used to further inform theories.
- Understand the characteristics of a good hypothesis.
- Define the concept of a variable, distinguish quantitative from categorical variables, and give examples of variables that might be of interest to psychologists.
- Explain the difference between a population and a sample.
- Distinguish between experimental and non-experimental research.
- Distinguish between lab studies, field studies, and field experiments.
- Distinguish between descriptive and inferential statistics.
- Identify the different kinds of descriptive statistics researchers use to summarize their data.
- Describe the purpose of inferential statistics.
- Distinguish between Type I and Type II errors.
- Identify the conclusions researchers can make based on the outcome of their studies.
- Describe why scientists avoid the term “scientific proof.”
- Explain the different ways that scientists share their findings.

KEY TERMS

APA PsycINFO
categorical variable
confounds
convenience sampling
correlation coefficient
dependent variable
double-blind peer review
edited volumes
empirical research reports
external validity
extraneous variables
feasibility
field experiments
field study
hypothesis
hypothetico-deductive method
independent variable
inferential statistics
interestingness
internal validity
laboratory study
logical
mean
median
meta-analysis
mode
monograph
operational definition
population
positive
professional journals
quantitative variable
range
research literature
review articles
sample
scholarly books
simple random sampling
standard of deviation
statistically significant
testable and falsifiable
theoretical article
theory
Type I error
Type II error
variable
variance

Here is the abstract of a 2014 article in the journal *Psychological Science.*

> Taking notes on laptops rather than in longhand is increasingly common. Many researchers have suggested that laptop note taking is less effective than longhand note taking for learning. Prior studies have primarily focused on students' capacity for multitasking and distraction when using laptops. The present research suggests that even when laptops are used solely to take notes, they may still be impairing learning because their use results in shallower processing. In three studies, we found that students who took notes on laptops performed worse on conceptual questions than students who took notes longhand. We show that whereas taking more notes can be beneficial, laptop note takers' tendency to transcribe lectures verbatim rather than processing information and reframing it in their own words is detrimental to learning. (Mueller & Oppenheimer, 2014, p. 1159)

In this abstract, the researcher has identified a research question—about the effect of taking notes on a laptop on learning—and identified why it is worthy of investigation—because the practice is ubiquitous and may be harmful to learning. In this chapter, we give you a broad overview of the various stages of the research process. These include finding a topic of investigation, reviewing the literature, refining your research question and generating a hypothesis, designing and conducting a study, analyzing the data, coming to conclusions, and reporting the results.

A MODEL OF SCIENTIFIC RESEARCH IN PSYCHOLOGY

FIGURE 3.1 presents a simple model of scientific research in psychology. The researchers formulate a research question, conduct an empirical study designed to answer the question, analyze the resulting data, draw conclusions about the answer to the question, and publish the results so that they become part of the research literature (i.e., all the published research in that field). Because the research literature is one of the primary sources of new research questions, this process can be thought of as a cycle. New research leads to new questions, which lead to new research, and so on. **FIGURE 3.1** also indicates that research questions can originate outside of this cycle either with informal observations or with practical problems that need to be solved. But even in these cases, the researcher would start by checking the research literature to see if the question had already been answered and to refine it based on what previous research had already found.

The research by Matthias Mehl and his colleagues is described nicely by this model. Their research question—whether women are more talkative than men—was suggested to them both by people's stereotypes and by claims published in the research literature about the relative talkativeness of

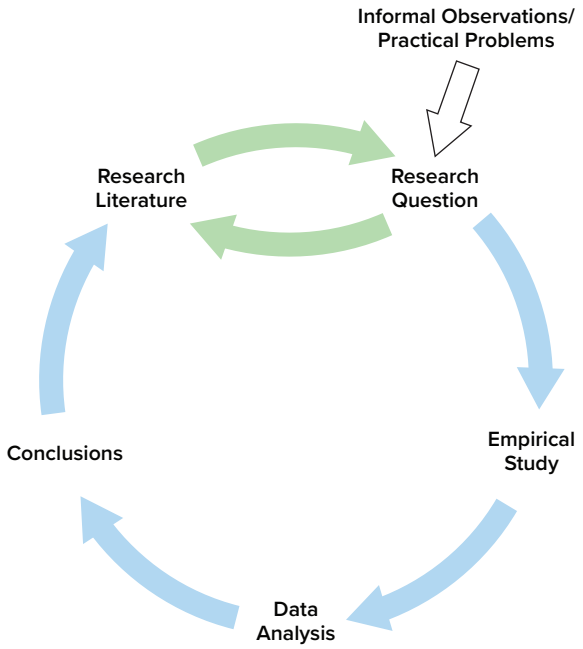


FIGURE 3.1. A simple model of scientific research in psychology. [This work, "Scientific Research in Psychology," is licensed under CC BY-SA 4.0 by Judy Schmitt. It is a derivative of "Figure 2.1 A Simple Model of Scientific Research in Psychology"/PressBooks, which is licensed under CC BY-SA 4.0.]

women and men. When they checked the research literature, however, they found that this question had not been adequately addressed in scientific studies. They then conducted a careful empirical study, analyzed the results (finding very little difference between women and men), formed their conclusions, and published their work so that it became part of the research literature. The publication of their article is not the end of the story, however, because their work suggests many new questions (about the reliability of the result, about potential cultural differences, etc.) that will likely be taken up by them and by other researchers inspired by their work.

VIDEO CLIP

View a brief video about using the scientific method to study distracted drivers.

As another example, consider that as cell phones became more widespread during the 1990s, people began to wonder whether, and to what extent, cell phone use had a negative effect on driving. Many psychologists decided to tackle this question scientifically (e.g., Collet et al., 2010). It was clear from previously published research that engaging in a simple verbal task impairs performance on a perceptual or motor task carried out at the same time, but no one had studied the effect specifically of cell phone use on driving. Under carefully controlled conditions, these researchers compared

people's driving performance while using a cell phone with their performance while not using a cell phone, both in the lab and on the road. They found that people's ability to detect road hazards, react quickly, and maintain control of the vehicle were all impaired by cell phone use. Each new study was published and became part of the growing research literature on this topic. For instance, other research teams subsequently demonstrated that cell phone conversations carry a greater risk than conversations with a passenger who is aware of driving conditions, which often become a point of conversation (e.g., Drews et al., 2004).

FINDING A RESEARCH TOPIC

Good research must begin with a good research question. Yet coming up with good research questions is something that novice researchers often find difficult and stressful. One reason is that this is a creative process that can appear mysterious—even magical—with experienced researchers seeming to pull interesting research questions out of thin air. However, psychological research on creativity has shown that it is neither as mysterious nor as magical as it appears. It is largely the product of ordinary thinking strategies and persistence (Weisberg, 1993). This section covers some fairly simple strategies for finding general research ideas, turning those ideas into empirically testable research questions, and finally evaluating those questions in terms of how interesting they are and how feasible they would be to answer.

Finding Inspiration

Research questions often begin as more general research ideas—usually focusing on some behavior or psychological characteristic: talkativeness, learning, depression, bungee jumping, and so on. Before looking at how to turn such ideas into empirically testable research questions, it is worth looking at where such ideas come from in the first place. Three of the most common sources of inspiration are informal observations, practical problems, and previous research.

Informal observations include direct observations of our own and others' behavior as well as secondhand observations from non-scientific sources such as newspapers, books, blogs, and so on. For example, you might notice that you always seem to be in the slowest moving line at the grocery store. Could it be that most people think the same thing? Or you might read in a local newspaper about people donating money and food to a local family whose house has burned down and begin to wonder about who makes such donations and why. Some of the most famous research in psychology has been inspired by informal observations. Stanley Milgram's famous research on obedience to authority, for example, was inspired in part by journalistic reports of the trials of accused Nazi war criminals—many of whom claimed that they were only obeying orders. This led him to wonder about the extent to which ordinary people will commit immoral acts simply because they are ordered to do so by an authority figure (Milgram, 1963).

Practical problems can also inspire research ideas, leading directly to applied research in such domains as law, health, education, and sports. Does taking lecture notes by hand improve students' exam performance? How effective is psychotherapy for depression compared to drug therapy? To what extent do cell phones impair people's driving ability? How can we teach children to read more efficiently? What is the best mental preparation for running a marathon?

Probably the most common inspiration for new research ideas, however, is previous research. Recall that science is a kind of large-scale collaboration in which many different researchers read and evaluate each other's work and conduct new studies to build on it. Of course, experienced researchers are familiar with previous research in their area of expertise and probably have a long list of ideas. This suggests that novice researchers can find inspiration by consulting with a more experienced researcher (e.g., students can consult a faculty member). But they can also find inspiration by picking up a copy of almost any professional journal and reading the titles and abstracts. In one typical issue of *Psychological Science*, for example, you can find articles on the perception of shapes, anti-Semitism, police lineups, the meaning of death, second-language learning, people who seek negative emotional experiences, and many other topics. If you can narrow your interests down to a particular topic (e.g., memory) or domain (e.g., health care), you can also look through more specific journals, such as *Memory & Cognition* or *Health Psychology*.

VIDEO CLIP

View a video showing how to develop a good research topic.

Reviewing the Research Literature

Once again, one of the most common sources of inspiration is previous research. Therefore, it is important to review the literature early in the research process. The **research literature** in any field is all the published research in that field. Reviewing the research literature means finding, reading, and summarizing the published research relevant to your topic of interest. In addition to helping you discover new research questions, reviewing the literature early in the research process can help you in several other ways.

- It can tell you if a research question has already been answered.
- It can help you evaluate the interestingness of a research question.

- It can give you ideas for how to conduct your own study.
- It can tell you how your study fits into the research literature.

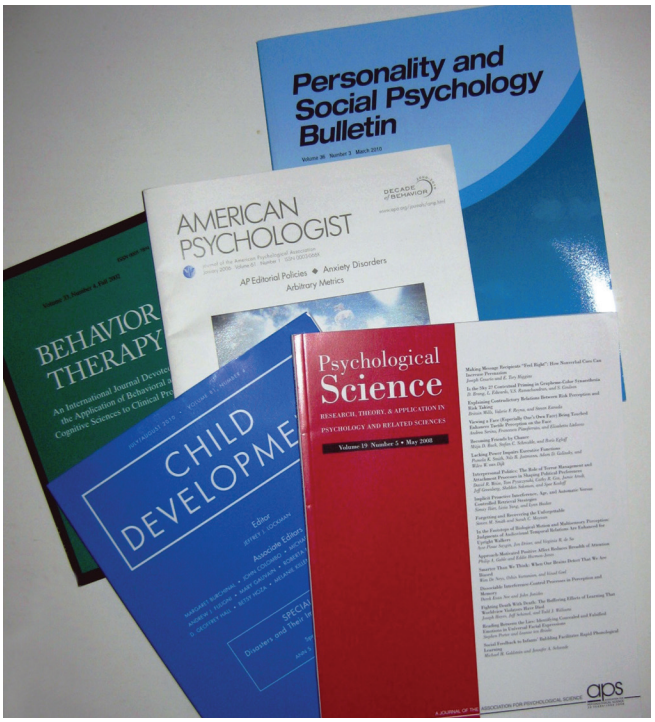
The research literature in psychology is enormous—including millions of scholarly articles and books dating to the beginning of the field—and it continues to grow. Although its boundaries are somewhat fuzzy, the research literature definitely does not include self-help and other pop psychology books, dictionary and encyclopedia entries, websites, and similar sources that are intended mainly for the general public. These are considered unreliable because they are not reviewed by other researchers and are often based on little more than common sense or personal experience. Wikipedia contains much valuable information, but because its authors are anonymous and may not have any formal training or expertise in that subject area, and its content continually changes, it is unsuitable as a basis of sound scientific research. For our purposes, it helps to define the research literature as consisting almost entirely of two types of sources: articles in professional journals and scholarly books in psychology and related fields.

Professional Journals

Professional journals are periodicals that publish original research articles. There are thousands of professional journals that publish research in psychology and related fields. They are usually published monthly or quarterly in individual issues, each of which contains several articles. The issues are organized into volumes, which usually consist of all the issues for a calendar year. Some journals are published in hard copy only, others in both hard copy and electronic form, and still others in electronic form only.

Most articles in professional journals are one of two basic types: empirical research reports and review articles. **Empirical research reports** describe one or more new empirical studies conducted by the authors. They introduce a research question, explain why it is interesting, review previous research, describe their method and results, and draw their conclusions. **Review articles** summarize previously published research on a topic and usually present new ways to organize or explain the results. When a review article is devoted primarily to presenting a new theory, it is often referred to as a **theoretical article**. When a review article provides a statistical summary of all of the previous results, it is referred to as a **meta-analysis**.

Most professional journals in psychology undergo a process of **double-blind peer review**. Researchers who want to publish their work in the journal submit a manuscript to the editor—who is generally an established researcher too—who in turn sends it to two or three experts on the topic. Each



Small sample of the thousands of professional journals that publish research in psychology and related fields. ["Figure 2.2" by Kwantlen Polytechnic University is licensed under CC BY-NC-SA 4.0.]

reviewer reads the manuscript, writes a critical but constructive review, and sends the review back to the editor along with recommendations about whether the manuscript should be published or not. The editor then decides whether to accept the article for publication, ask the authors to make changes and resubmit it for further consideration, or reject it outright. In any case, the editor forwards the reviewers' written comments to the researchers so that they can revise their manuscript accordingly. This entire process is double-blind, as the reviewers do not know the identity of the researcher(s) and vice versa. Double-blind peer review is helpful because it ensures that the work meets basic standards of the field before it can enter the research literature. However, in order to increase transparency and accountability, some newer open access journals (e.g., Frontiers in Psychology) utilize an open peer review process wherein the identities of the reviewers (which remain concealed during the peer review process) are published alongside the journal article.

Scholarly Books

Scholarly books are books written by researchers and practitioners mainly for use by other researchers and practitioners. A **monograph** is written by a single author or a small group of authors and usually gives a coherent presentation of a topic, much like an extended review article. **Edited volumes** have an editor or a small group of editors who recruit many

authors to write separate chapters on different aspects of the same topic. Although edited volumes can also give a coherent presentation of the topic, it is not unusual for each chapter to take a different perspective or even for the authors of different chapters to openly disagree with each other. In general, scholarly books undergo a peer review process similar to that used by professional journals.

Literature Search Strategies

Using APA PsycINFO and Other Databases

The primary method used to search the research literature involves using one or more electronic databases. These include Academic Search Premier and JSTOR for all academic disciplines, ERIC for education, and PubMed for medicine and related fields. The most important for our purposes, however, is **APA PsycINFO** (formerly known simply as PsycINFO), which is produced by the American Psychological Association (APA). APA PsycINFO is so comprehensive—covering thousands of professional journals and scholarly books going back more than 100 years—that for most purposes its content is synonymous with the research literature in psychology. Like most such databases, APA PsycINFO is usually available through your university library.

APA PsycINFO consists of individual records for each article, book chapter, or book in the database. A computer interface allows entering one or more search terms and returns any records that contain those search terms. (These interfaces are provided by different vendors and therefore can look somewhat different depending on the library you use.) Each record includes basic publication information, an abstract or summary of the work (like the one presented at the start of this chapter), a list of other works cited by that work, and a list of keywords that describe the content of the work, and a list of index terms. The index terms are especially helpful because they are standardized. Research on differences between females and males, for example, is always indexed under "Human Sex Differences." Research on note-taking is always indexed under the term "Learning Strategies." If you do not know the appropriate index terms, APA PsycINFO includes a thesaurus that can help you find them.

Given that there are nearly four million records in APA PsycINFO, you may have to try a variety of search terms in different combinations and at different levels of specificity before you find what you are looking for. Imagine, for example, that you are interested in the question of whether males and females differ in terms of their ability to recall experiences from when they were very young. If you were to enter the search term "memory," it would return far too many records to look through individually. This is where the thesaurus helps. Entering "memory" into the thesaurus provides several more specific index terms—one of which is "early memories." While searching for "early memories" among the index terms still returns too many to look through individually—combining it with "human sex differences" as a second search term returns fewer articles, many of which are highly relevant to the topic.

Depending on the vendor that provides the interface to APA PsycINFO, you may be able to save, print, or e-mail the relevant APA PsycINFO records. The records might even contain links to full-text copies of the works themselves. (APA PsycARTICLES, formerly called simply PsycARTICLES, is a database that provides full-text access to articles in all journals published by the APA.) If not, and you want a copy of the work, you will have to find out if your library carries the journal or has the book and the hard copy on the library shelves. Be sure to ask a librarian if you need help.

VIDEO CLIP

View a video illustrating how to do an APA PsycINFO search.

Using Other Search Techniques

In addition to entering search terms into APA PsycINFO and other databases, there are several other techniques you can use to search the research literature. First, if you have one good article or book chapter on your topic—a recent review article is best—you can look through the reference list of that article for other relevant articles, books, and book chapters. In fact, you should do this with any relevant article or book chapter you find. You can also start with a classic article or book chapter on your topic, find its record in APA PsycINFO (by entering the author's name or the article's title as a search term), and link from there to a list of other works in APA PsycINFO that cite that classic article. This works because other researchers working on your topic are likely to be aware of the classic article and cite it in their own work. You can also do a general Internet search using search terms related to your topic or the name of a researcher who conducts research on your topic. This might lead you directly to works that are part of the research literature (e.g., articles in open-access journals or posted on researchers' own websites). The search engine Google Scholar is especially useful for this purpose. A general Internet search might also lead you to websites that are not part of the research literature but might provide references to works that are. Finally, you can talk to people (e.g., your instructor or other faculty members in psychology) who know something about your topic and can suggest relevant articles and book chapters.

VIDEO CLIP

View a video showing how to do a search using Google Scholar.

What to Search For

When you do a literature review, you need to be selective. Not every article, book chapter, and book that relates to your research idea or question will be worth obtaining, reading, and integrating into your review. Instead, you want to focus on sources that help you do four basic things: (a) refine your research question, (b) identify appropriate research methods, (c) place your research in the context of previous research, and (d) write an effective research report. Several basic principles can help you find the most useful sources.

First, it is best to focus on recent research, keeping in mind that what counts as recent depends on the topic. For newer topics that are actively being studied, "recent" might mean published in the past year or two. For older topics that are receiving less attention right now, "recent" might mean within the past 10 years. You will get a feel for what counts as recent for your topic when you start your literature search. A good general rule, however, is to start with sources published in the past five years. The main exception to this rule would be classic articles that turn up in the reference list of nearly every other source. If other researchers think that this work is important, even though it is old, then, by all means, you should include it in your review.

Second, you should look for review articles on your topic because they will provide a useful overview of it—often discussing important definitions, results, theories, trends, and controversies—giving you a good sense of where your own research fits into the literature. You should also look for empirical research reports addressing your question or similar questions, which can give you ideas about how to measure your variables and collect your data. As a general rule, it is good to use methods that others have already used successfully unless you have good reasons not to. Finally, you should look for sources that provide information that can help you argue for the interestingness of your research question. For a study on the effects of cell phone use on driving ability, for example, you might look for information about how widespread cell phone use is, how frequent and costly motor vehicle crashes are, and so on.

How many sources are enough for your literature review? This is a difficult question because it depends on how extensively your topic has been studied and also on your own goals. One study found that across a variety of professional journals in psychology, the average number of sources cited per article was about 50 (Adair & Vohra, 2003). This gives a rough idea of what professional researchers consider to be adequate. As a student, you might be assigned a much lower minimum number of references to include, but the principles for selecting the most useful ones remain the same.

GENERATING GOOD RESEARCH QUESTIONS

Generating Empirically Testable Research Questions

Once you have a research idea, you need to use it to generate one or more empirically testable research questions, that is, questions expressed in terms of a single variable or relationship between variables. One way to do this is to look closely at the discussion section in a recent research article on the topic. This is the last major section of the article, in which the researchers summarize their results, interpret them in the context of past research, and suggest directions for future research. These suggestions often take the form of specific research questions, which you can then try to answer with additional research. This can be a good strategy because it is likely that the suggested questions have already been identified as interesting and important by experienced researchers.

But you may also want to generate your own research questions. How can you do this? First, if you have a particular behavior or psychological characteristic in mind, you can simply conceptualize it as a variable and ask how frequent or intense it is. How many words on average do people speak per day? How accurate are our memories of traumatic events? What percentage of people have sought professional help for depression? If the question has never been studied scientifically—which is something that you will learn when you conduct your literature review—then it might be interesting and worth pursuing.

If scientific research has already answered the question of how frequent or intense the behavior or characteristic is, then you should consider turning it into a question about a relationship between that behavior or characteristic and some other variable. One way to do this is to ask yourself the following series of more general questions and write down all the answers you can think of.

- What are some possible causes of the behavior or characteristic?
- What are some possible effects of the behavior or characteristic?
- What types of people might exhibit more or less of the behavior or characteristic?
- What types of situations might elicit more or less of the behavior or characteristic?

In general, each answer you write down can be conceptualized as a second variable, suggesting a question about a relationship. If you were interested in talkativeness, for example, it might occur to you that a possible cause of this psychological characteristic is family size. Is there a relationship between family size and talkativeness? Or it might occur to

you that people seem to be more talkative in same-sex groups than mixed-sex groups. Is there a difference in the average level of talkativeness of people in same-sex groups and people in mixed-sex groups? This approach should allow you to generate many different empirically testable questions about almost any behavior or psychological characteristic.

If through this process you generate a question that has never been studied scientifically—which again is something that you will learn in your literature review—then it might be interesting and worth pursuing. But what if you find that it has been studied scientifically? Although novice researchers often want to give up and move on to a new question at this point, this is not necessarily a good strategy. For one thing, the fact that the question has been studied scientifically and the research published suggests that it is of interest to the scientific community. For another, the question can almost certainly be refined so that its answer will still contribute something new to the research literature. Again, asking yourself a series of more general questions about the relationship is a good strategy.

- Are there other ways to define and measure the variables?
- Are there types of people for whom the relationship might be stronger or weaker?
- Are there situations in which the relationship might be stronger or weaker—including situations with practical importance?

For example, research has shown that women and men speak about the same number of words per day—but this was when talkativeness was measured in terms of the number of words spoken per day among university students in the United States and Mexico. We can still ask whether other ways of measuring talkativeness—perhaps the number of different people spoken to each day—produce the same result. Or we can ask whether studying elderly people or people from other cultures produces the same result. Again, this approach should help you generate many different research questions about almost any relationship.

Evaluating Research Questions

Researchers usually generate many more research questions than they ever attempt to answer. This means they must have some way of evaluating the research questions they generate so that they can choose which ones to pursue. In this section, we consider two criteria for evaluating research questions: the interestingness of the question and the feasibility of answering it.

Interestingness

How often do people tie their shoes? Do people feel pain when you punch them in the jaw? Are women more likely to wear makeup than men? Do people prefer vanilla or chocolate ice cream? Although it would be a fairly simple matter to design a study and collect data to answer these questions, you probably would not want to because they are not interesting. We are not talking here about whether a research question is interesting to us personally but whether it is interesting to people more generally and, especially, to the scientific community. But what makes a research question interesting in this sense? Here we look at three factors that affect the **interestingness** of a research question: the answer is in doubt, the answer fills a gap in the research literature, and the answer has important practical implications.

First, a research question is interesting to the extent that its answer is in doubt. Obviously, questions that have been answered by scientific research are no longer interesting as the subject of new empirical research. But the fact that a question has not been answered by scientific research does not necessarily make it interesting. There has to be some reasonable chance that the answer to the question will be something that we did not already know. But how can you assess this before actually collecting data? One approach is to try to think of reasons to expect different answers to the question—especially ones that seem to conflict with common sense. If you can think of reasons to expect at least two different answers, then the question might be interesting. If you can think of reasons to expect only one answer, then it probably is not. The question of whether women are more talkative than men is interesting because there are reasons to expect both answers. The existence of the stereotype itself suggests the answer could be yes, but the fact that women's and men's verbal abilities are fairly similar suggests the answer could be no. The question of whether people feel pain when you punch them in the jaw is not interesting because there is absolutely no reason to think that the answer could be anything other than a resounding yes.

A second important factor to consider when deciding if a research question is interesting is whether answering it will fill a gap in the research literature. Again, this means in part that the question has not already been answered by scientific research. But it also means that the question is in some sense a natural one for people who are familiar with the research literature. For example, the question of whether taking lecture notes by hand can help improve students' exam performance would be likely to occur to anyone who was familiar with research on note taking and the ineffectiveness of shallow processing on learning.

A final factor to consider when deciding whether a research question is interesting is whether its answer has important practical implications. Again, the question of whether taking notes by hand improves learning has important implications

for education, including classroom policies concerning technology use. The question of whether cell phone use impairs driving is interesting because it is relevant to the personal safety of everyone who travels by car and to the debate over whether cell phone use should be restricted by law.

Feasibility

A second important criterion for evaluating research questions is the **feasibility** of successfully answering them. There are many factors that affect feasibility, including time, money, equipment and materials, technical knowledge and skill, and access to research participants. Clearly, researchers need to take these factors into account so that they do not waste time and effort pursuing research they cannot complete successfully.

Looking through a sample of professional journals in psychology will reveal many studies that are complicated and difficult to carry out. These include longitudinal designs in which participants are tracked over many years, neuroimaging studies in which participants' brain activity is measured while they carry out various mental tasks, and complex non-experimental studies involving several variables and complicated statistical analyses. Keep in mind, though, that such research tends to be carried out by teams of highly trained researchers whose work is often supported in part by government and private grants. Also, keep in mind that research does not have to be complicated or difficult to produce interesting and important results. Looking through a sample of professional journals will also reveal studies that are relatively simple and easy to carry out—perhaps involving a convenience sample of university students and a paper-and-pencil task.

A final point here is that it is generally good practice to use methods that have already been used successfully by other researchers. For example, if you want to manipulate people's moods to make some of them happy, it would be a good idea to use one of the many approaches that have been used successfully by other researchers (e.g., paying them a compliment). This is good not only for the sake of feasibility—the approach is "tried and true"—but also because it provides greater continuity with previous research. This makes it easier to compare your results with those of other researchers and to understand the implications of their research for yours, and vice versa.

DEVELOPING A HYPOTHESIS

Theories and Hypotheses

Before describing how to develop a hypothesis, it is important to distinguish between a theory and a hypothesis. A **theory** is a coherent explanation or interpretation of one or more phenomena. Although theories can take a variety of forms, one thing they have in common is that they go beyond the phenomena they explain by including variables, structures, processes, functions, or organizing principles that have not been observed directly. Consider, for example, Zajonc's theory of social facilitation and social inhibition (1965). He proposed that being watched by others while performing a task creates a general state of physiological arousal, which increases the likelihood of the dominant (most likely) response. So for highly practiced tasks, being watched increases the tendency to make correct responses, but for relatively unpracticed tasks, being watched increases the tendency to make incorrect responses. Notice that this theory—which has come to be called drive theory—provides an explanation of both social facilitation and social inhibition that goes beyond the phenomena themselves by including concepts such as "arousal" and "dominant response," along with processes such as the effect of arousal on the dominant response.

Outside of science, referring to an idea as a theory often implies that it is untested—perhaps no more than a wild guess. In science, however, the term theory has no such implication. A theory is simply an explanation or interpretation of a set of phenomena. It can be untested, but it can also be extensively tested, well supported, and accepted as an accurate description of the world by the scientific community. The theory of evolution by natural selection, for example, is a theory because it is an explanation of the diversity of life on earth—not because it is untested or unsupported by scientific research. On the contrary, the evidence for this theory is overwhelmingly positive and nearly all scientists accept its basic assumptions as accurate. Similarly, the "germ theory" of disease is a theory because it is an explanation of the origin of various diseases, not because there is any doubt that many diseases are caused by microorganisms that infect the body.

A **hypothesis**, on the other hand, is a specific prediction about a new phenomenon that should be observed if a particular theory is accurate. It is an explanation that relies on just a few key concepts. Hypotheses are often specific predictions about what will happen in a particular study. They are developed by considering existing evidence and using reasoning to infer what will happen in the specific context of interest. Hypotheses are often but not always derived from theories. So a hypothesis is often a prediction based on a theory but some hypotheses are atheoretical and only after a set of observations has been made is a theory developed. This is because theories are broad in nature and explain larger bodies of data. So if our research question is really original then we may need to collect some data and make some observations before we can develop a broader theory.

Theories and hypotheses always have this *if-then* relationship. "*If* drive theory is correct, *then* cockroaches should run through a straight runway faster and through a branching runway more slowly when other cockroaches are present." Although hypotheses are usually expressed as statements, they can always be rephrased as questions. "Do cockroaches

run through a straight runway faster when other cockroaches are present?" Thus, deriving hypotheses from theories is an excellent way of generating interesting research questions.

But how do researchers derive hypotheses from theories? One way is to generate a research question using the techniques discussed in this chapter and then ask whether any theory implies an answer to that question. For example, you might wonder whether expressive writing about positive experiences improves health as much as expressive writing about traumatic experiences. Although this question is an interesting one on its own, you might then ask whether the habituation theory—the idea that expressive writing causes people to habituate to negative thoughts and feelings—implies an answer. In this case, it seems clear that if the habituation theory is correct, then expressive writing about positive experiences should not be effective because it would not cause people to habituate to negative thoughts and feelings. A second way to derive hypotheses from theories is to focus on some component of the theory that has not yet been directly observed. For example, a researcher could focus on the process of habituation—perhaps hypothesizing that people should show fewer signs of emotional distress with each new writing session.

Among the very best hypotheses are those that distinguish between competing theories. For example, Norbert Schwarz and his colleagues considered two theories of how people make judgments about themselves, such as how assertive they are (Schwarz et al., 1991). Both theories held that such judgments are based on relevant examples that people bring to mind. However, one theory was that people base their judgments on the number of examples they bring to mind and the other was that people base their judgments on how easily they bring those examples to mind. To test these theories, the researchers asked people to recall either six times when they were assertive (which is easy for most people) or 12 times (which is difficult for most people). Then they asked them to judge their own assertiveness. Note that the number-of-examples theory implies that people who recalled 12 examples should judge themselves to be more assertive because they recalled more examples, but the ease-of-examples theory implies that participants who recalled six examples should judge themselves as more assertive because recalling the examples was easier. Thus the two theories made opposite predictions so that only one of the predictions could be confirmed. The surprising result was that participants who recalled fewer examples judged themselves to be more assertive—providing particularly convincing evidence in favor of the ease-of-retrieval theory over the number-of-examples theory.

Theory Testing

The primary way that scientific researchers use theories is sometimes called the **hypothetico-deductive method** (although this term is much more likely to be used by philosophers of science than by scientists themselves). Researchers begin with a set of phenomena and either construct a theory to explain or interpret the phenomena or choose an existing theory to work with. They then make a prediction about some new phenomenon that should be observed if the theory is correct. Again, this prediction is called a hypothesis. The researchers then conduct an empirical study to test the hypothesis. Finally, they reevaluate the theory in light of the new results and revise it if necessary. This process is usually conceptualized as a cycle because the researchers can then derive a new hypothesis from the revised theory, conduct a new empirical study to test the hypothesis, and so on. As **FIGURE 3.2** shows, this approach meshes nicely with the model of scientific research in psychology presented earlier in the textbook—creating a more detailed model of "theoretically motivated" or "theory-driven" research.

As an example, let us consider Zajonc's research on social facilitation and inhibition. He started with a somewhat contradictory pattern of results from the research literature. He then constructed his drive theory, according to which being watched by others while performing a task causes physiological arousal, which increases an organism's tendency to make the dominant response. This theory predicts social facilitation for well-learned tasks and social inhibition for poorly

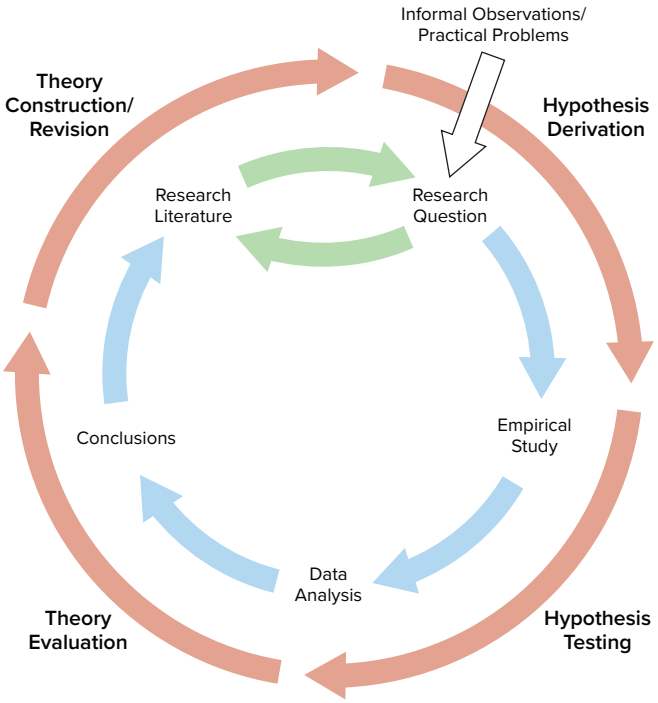


FIGURE 3.2. Hypothetico-deductive method combined with the general model of scientific research in psychology. Together they form a model of theoretically motivated research. [This work, "Hypothetico-Deductive Method," is licensed under CC BY-SA 4.0 by Judy Schmitt. It is a derivative of "Figure 2.2 Hypothetico-Deductive Method Combined With the General Model of Scientific Research in Psychology"/ PressBooks, which is licensed under CC BY-SA 4.0.]

learned tasks. He now had a theory that organized previous results in a meaningful way—but he still needed to test it. He hypothesized that if his theory was correct, he should observe that the presence of others improves performance in a simple laboratory task but inhibits performance in a difficult version of the very same laboratory task. To test this hypothesis, one of the studies he conducted used cockroaches as subjects (Zajonc, Heingartner, & Herman, 1969). The cockroaches ran either down a straight runway (an easy task for a cockroach) or through a cross-shaped maze (a difficult task for a cockroach) to escape into a dark chamber when a light was shined on them. They did this either while alone or in the presence of other cockroaches in clear plastic "audience boxes." Zajonc found that cockroaches in the straight runway reached their goal more quickly in the presence of other cockroaches, but cockroaches in the cross-shaped maze reached their goal more slowly when they were in the presence of other cockroaches. Thus he confirmed his hypothesis and provided support for his drive theory. (Zajonc also showed that drive theory existed in humans [Zajonc & Sales, 1966] in many other studies afterward).

Incorporating Theory into Your Research

When you write your research report or plan your presentation, be aware that there are two basic ways that researchers usually include theory. The first is to raise a research question, answer that question by conducting a new study, and then offer one or more theories (usually more) to explain or interpret the results. This format works well for applied research questions and for research questions that existing theories do not address. The second way is to describe one or more existing theories, derive a hypothesis from one of those theories, test the hypothesis in a new study, and finally reevaluate the theory. This format works well when there is an existing theory that addresses the research question—especially if the resulting hypothesis is surprising or conflicts with a hypothesis derived from a different theory.

To use theories in your research will not only give you guidance in coming up with experiment ideas and possible projects, but it lends legitimacy to your work. Psychologists have been interested in a variety of human behaviors and have developed many theories along the way. Using established theories will help you break new ground as a researcher, not limit you from developing your own ideas.

Characteristics of a Good Hypothesis

There are three general characteristics of a good hypothesis. First, a good hypothesis must be **testable and falsifiable**. We must be able to test the hypothesis using the methods of science, and it must be possible to gather evidence that will disconfirm the hypothesis if it is indeed false. Second, a good hypothesis must be **logical**. As described above, hypotheses are more than just a random guess. Hypotheses should be informed by previous theories or observations and logical reasoning. Typically, we begin with a broad and general theory and use deductive reasoning to generate a more specific hypothesis to test based on that theory. Occasionally, however, when there is no theory to inform our hypothesis, we use *inductive reasoning* which involves using specific observations or research findings to form a more general hypothesis. Finally, the hypothesis should be **positive**. That is, the hypothesis should make a positive statement about the existence of a relationship or effect, rather than a statement that a relationship or effect does not exist. As scientists, we don't set out to show that relationships do not exist or that effects do not occur so our hypotheses should not be worded in a way to suggest that an effect or relationship does not exist. The nature of science is to assume that something does not exist and then seek to find evidence to prove this wrong, to show that it really does exist. That may seem backward to you but that is the nature of the scientific method. The underlying reason for this is beyond the scope of this chapter but it has to do with statistical theory.

DESIGNING A RESEARCH STUDY

Identifying and Defining the Variables and Population

Variables and Operational Definitions

Part of generating a hypothesis involves identifying the variables you want to study and operationally defining those variables so they can be measured. Research questions in psychology are about variables. A **variable** is a quantity or quality that varies across people or situations. For example, the height of the students enrolled in a university course is a variable because it varies from student to student. The chosen major of the students is also a variable as long as not everyone in the class has declared the same major. Almost everything in our world varies, so thinking of examples of constants (things that don't vary) is far more difficult. A rare example of a constant is the speed of light. Variables can be either quantitative or categorical. A **quantitative variable** is a quantity, such as height, that is typically measured by assigning a number to each individual. Other examples of quantitative variables include people's level of talkativeness, how depressed they are, and the number of siblings they have. A **categorical variable** is a quality, such as chosen major, and is typically measured by assigning a category label to each individual (e.g., Psychology, English, Nursing, etc.). Other examples include people's nationality, their occupation, and whether they are receiving psychotherapy.

After the researcher generates their hypothesis and selects the variables they want to manipulate and measure, the

researcher needs to find ways to actually measure the variables of interest. This requires an **operational definition**—a definition of the variable in terms of precisely how it is to be measured. Most variables that researchers are interested in studying cannot be directly observed or measured, and this poses a problem because empiricism (observation) is at the heart of the scientific method. Operationally defining a variable involves taking an abstract construct like depression that cannot be directly observed and transforming it into something that can be directly observed and measured. Most variables can be operationally defined in many different ways. For example, depression can be operationally defined as people's scores on a paper-and-pencil depression scale such as the Beck Depression Inventory, the number of depressive symptoms they are experiencing, or whether they have been diagnosed with major depressive disorder. Researchers are wise to choose an operational definition that has been used extensively in the research literature.

Sampling and Measurement

In addition to identifying which variables to manipulate and measure, and operationally defining those variables, researchers need to identify the population of interest. Researchers in psychology are usually interested in drawing conclusions about some very large group of people. This is called the **population**. It could be all American teenagers, children with autism, professional athletes, or even just human beings—depending on the interests and goals of the researcher. But they usually study only a small subset or **sample** of the population. For example, a researcher might measure the talkativeness of a few hundred university students with the intention of drawing conclusions about the talkativeness of men and women in general. It is important, therefore, for researchers to use a representative sample—one that is similar to the population in important respects.

One method of obtaining a sample is **simple random sampling**, in which every member of the population has an equal chance of being selected for the sample. For example, a pollster could start with a list of all the registered voters in a city (the population), randomly select 100 of them from the list (the sample), and ask those 100 whom they intend to vote for. Unfortunately, random sampling is difficult or impossible in most psychological research because the populations are less clearly defined than the registered voters in a city. How could a researcher give all American teenagers or all children with autism an equal chance of being selected for a sample? The most common alternative to random sampling is **convenience sampling**, in which the sample consists of individuals who happen to be nearby and willing to participate (such as introductory psychology students). Of course, the obvious problem with convenience sampling is that the sample might not be representative of the population and therefore it may be less appropriate to generalize the results from the sample to that population.

Experimental vs. Non-Experimental Research

The next step a researcher must take is to decide which type of approach they will use to collect the data. As you will learn in your research methods course there are many different approaches to research that can be divided in many different ways. One of the most fundamental distinctions is between experimental and non-experimental research.

Experimental Research

Researchers who want to test hypotheses about causal relationships between variables (i.e., their goal is to explain) need to use an experimental method. This is because the experimental method is the only method that allows us to determine causal relationships. Using the experimental approach, researchers first manipulate one or more variables while attempting to control extraneous variables, and then they measure how the manipulated variables affect participants' responses.

The terms *independent variable* and *dependent variable* are used in the context of experimental research. The **independent variable** is the variable the experimenter manipulates (it is the presumed cause) and the **dependent variable** is the variable the experimenter measures (it is the presumed effect).

Extraneous variables are any variable other than the dependent variable. **Confounds** are a specific type of extraneous variable that systematically varies along with the variables under investigation and therefore provides an alternative explanation for the results. When researchers design an experiment they need to ensure that they control for confounds; they need to ensure that extraneous variables don't become confounding variables because in order to make a causal conclusion they need to make sure alternative explanations for the results have been ruled out.

As an example, if we manipulate the lighting in the room and examine the effects of that manipulation on workers' productivity, then the lighting conditions (bright lights vs. dim lights) would be considered the independent variable and the workers' productivity would be considered the dependent variable. If the bright lights are noisy then that noise would be a confound since the noise would be present whenever the lights are bright and the noise would be absent when the lights are dim. If noise is varying systematically with light then we wouldn't know if a difference in worker productivity across the two lighting conditions is due to noise or light. So confounds are bad, they disrupt our ability to make causal conclusions about the nature of the relationship between

variables. However, if there is noise in the room both when the lights are on and when the lights are off then noise is merely an extraneous variable (it is a variable other than the independent or dependent variable), and we don't worry much about extraneous variables. This is because, unless a variable varies systematically with the manipulated independent variable, it cannot be a competing explanation for the results.

Non-Experimental Research

Researchers who are simply interested in describing characteristics of people, describing relationships between variables, and using those relationships to make predictions can use non-experimental research. Using the non-experimental approach, the researcher simply measures variables as they naturally occur, but they do not manipulate them. For instance, if I just measured the number of traffic fatalities in America last year that involved the use of a cell phone but I did not actually manipulate cell phone use then this would be categorized as non-experimental research. Alternatively, if I stood at a busy intersection and recorded drivers' genders and whether or not they were using a cell phone when they passed through the intersection to see whether men or women are more likely to use a cell phone when driving, then this would be non-experimental research. It is important to point out that non-experimental does not mean nonscientific. Non-experimental research is scientific in nature. It can be used to fulfill two of the three goals of science (to describe and to predict). However, unlike with experimental research, we cannot make causal conclusions using this method; we cannot say that one variable causes another variable using this method.

Laboratory vs. Field Research

The next major distinction between research methods is between laboratory and field studies. A **laboratory study** is a study that is conducted in the laboratory environment. In contrast, a **field study** is a study that is conducted in the real world, in a natural environment.

Laboratory experiments typically have high **internal validity**. Internal validity refers to the degree to which we can confidently infer a causal relationship between variables. When we conduct an experimental study in a laboratory environment, we have very high internal validity because we manipulate one variable while controlling all other outside extraneous variables. When we manipulate an independent variable and observe an effect on a dependent variable and we control for everything else so that the only difference between our experimental groups or conditions is the one manipulated variable, then we can be quite confident that it is the independent variable that is causing the change in the dependent variable. In contrast, because field studies are conducted in the real world, the experimenter typically has less control over the environment and potential extraneous variables, and this decreases internal validity, making it less appropriate to arrive at causal conclusions.

But there is typically a trade-off between internal and external validity. **External validity** simply refers to the degree to which we can generalize the findings to other circumstances or settings, like the real-world environment. When internal validity is high, external validity tends to be low; and when internal validity is low, external validity tends to be high. So laboratory studies are typically low in external validity, while field studies are typically high in external validity. Since field studies are conducted in the real-world environment it is far more appropriate to generalize the findings to that real-world environment than when the research is conducted in the more artificial sterile laboratory.

Finally, there are field studies, which are non-experimental in nature because nothing is manipulated. But there are also **field experiments** where an independent variable is manipulated in a natural setting and extraneous variables are controlled. Depending on their overall quality and the level of control of extraneous variables, such field experiments can have high external and high internal validity.

ANALYZING THE DATA

Once the study is complete and the observations have been made and recorded, the researchers need to analyze the data and draw their conclusions. Typically, data are analyzed using both descriptive and inferential statistics. Descriptive statistics are used to summarize the data and inferential statistics are used to generalize the results from the sample to the population. In turn, inferential statistics are used to make conclusions about whether or not a theory has been supported or refuted, or requires modification.

Descriptive Statistics

Descriptive statistics are used to organize or summarize a set of data. Examples include percentages, measures of central tendency (mean, median, mode), measures of dispersion (range, standard deviation, variance), and correlation coefficients.

Measures of central tendency are used to describe the typical, average, and center of a distribution of scores. The **mode** is the most frequently occurring score in a distribution. The **median** is the midpoint of a distribution of scores. The **mean** is the average of a distribution of scores.

Measures of dispersion are also considered descriptive statistics. They are used to describe the degree of spread in a set of scores. Are all of the scores similar and clustered around the mean, or is there a lot of variability in the scores? The **range** is a measure of dispersion that measures the distance between the highest and lowest scores in a distribution. The **standard deviation** is a more sophisticated measure of dispersion that measures the average distance of scores from the mean. The **variance** is simply the standard deviation squared,

so it also measures the distance of scores from the mean but in a different unit of measure.

Typically, means and standard deviations are computed for experimental research studies in which an independent variable was manipulated to produce two or more groups and a dependent variable was measured quantitatively. The means from each experimental group or condition are calculated separately and are compared to see if they differ.

For non-experimental research, simple percentages may be computed to describe the percentage of people who engaged in some behavior or held some belief. But more commonly, non-experimental research involves computing the correlation between two variables. A **correlation coefficient** describes the strength and direction of the relationship between two variables. The values of a correlation coefficient can range from −1.00 (the strongest possible negative relationship) to +1.00 (the strongest possible positive relationship). A value of 0 means there is no relationship between the two variables. Positive correlation coefficients indicate that as the values of one variable increase, so do the values of the other variable. A good example of a positive correlation is the correlation between height and weight, because as height increases weight also tends to increase. Negative correlation coefficients indicate that as the value of one variable increase, the values of the other variable decrease. An example of a negative correlation is the correlation between stressful life events and happiness, because as stress increases, happiness is likely to decrease.

Inferential Statistics

As you learned in the section of this chapter on sampling, typically researchers sample from a population but ultimately they want to be able to generalize their results from the sample to a broader population. Researchers typically want to infer what the population is like based on the sample they studied. **Inferential statistics** are used for that purpose. Inferential statistics allow researchers to draw conclusions about a population based on data from a sample. Inferential statistics are crucial because the effects (i.e., the differences in the means or the correlation coefficient) that researchers find in a study may be due simply to random chance variability or they may be due to a real effect (i.e., they may reflect a real relationship between variables or a real effect of an independent variable on a dependent variable).

Researchers use inferential statistics to determine whether their effects are statistically significant. A **statistically significant** effect is one that is unlikely due to random chance and therefore likely represents a real effect in the population. More specifically, results that have less than a 5% chance of being due to random error are typically considered statistically significant. When an effect is statistically significant it is appropriate to generalize the results from the sample to the population. In contrast, if inferential statistics reveal that there is more than a 5% chance that an effect could be due to chance error alone, then the researcher must conclude that the result is not statistically significant.

It is important to keep in mind that statistics are probabilistic in nature. They allow researchers to determine whether the chances are low that their results are due to random error, but they don't provide any absolute certainty. Hopefully, when we conclude that an effect is statistically significant it is a real effect that we would find if we tested the entire population. And, hopefully, when we conclude that an effect is not statistically significant there really is no effect, and if we tested the entire population we would find no effect. That 5% threshold is set at 5% to ensure that there is a high probability that we make a correct decision and that our determination of statistical significance is an accurate reflection of reality.

But mistakes can always be made. Specifically, two kinds of mistakes can be made. First, researchers can make a **Type I error**, which is a false positive. It is when a researcher concludes that their results are statistically significant (so they say there is an effect in the population) when in reality there is no real effect in the population and the results are just due to chance (they are a fluke). When the threshold is set to 5%, which is the convention, then the researcher has a 5% chance or less of making a Type I error. You might wonder why researchers don't set it even lower to reduce the chances of making a Type I error. The reason is when the chances of making a Type I error are reduced, the chances of making a Type II error are increased. A **Type II error** is a missed opportunity. It is when a researcher concludes that their results are not statistically significant when in reality there is a real effect in the population and they just missed detecting it. Once again, these Type II errors are more likely to occur when the threshold is set too low (e.g., set at 1% instead of 5%) and/or when the sample was too small.

DRAWING CONCLUSIONS AND REPORTING THE RESULTS

Drawing Conclusions

Since statistics are probabilistic in nature and findings can reflect Type I or Type II errors, we cannot use the results of a single study to conclude with certainty that a theory is true. Rather, theories are supported, refuted, or modified based on the results of research.

If the results are statistically significant and consistent with the hypothesis and the theory that was used to generate the hypothesis, then researchers can conclude that the theory is supported. Not only did the theory make an accurate prediction, but there is now a new phenomenon that the theory accounts for. If a hypothesis is disconfirmed in a systematic empirical study, then the theory has been weakened. It made an inaccurate prediction, and there is now a new phenomenon that it does not account for.

Although this seems straightforward, there are some complications. First, confirming a hypothesis can strengthen a theory but it can never prove a theory. In fact, scientists tend to avoid the word "prove" when talking and writing about theories. One reason for this avoidance is that the result may reflect a Type I error. Another reason for this avoidance is that there may be other plausible theories that imply the same hypothesis, which means that confirming the hypothesis strengthens all those theories equally. A third reason is that it is always possible that another test of the hypothesis or a test of a new hypothesis derived from the theory will be disconfirmed. This difficulty is a version of the famous philosophical "problem of induction." One cannot definitively prove a general principle (e.g., "All swans are white.") just by observing confirming cases (e.g., white swans)—no matter how many. It is always possible that a disconfirming case (e.g., a black swan) will eventually come along. For these reasons, scientists tend to think of theories—even highly successful ones—as subject to revision based on new and unexpected observations.

A second complication has to do with what it means when a hypothesis is disconfirmed. According to the strictest version of the hypothetico-deductive method, disconfirming a hypothesis disproves the theory it was derived from. In formal logic, the premises "if *A* then *B*" and "not *B*" necessarily lead to the conclusion "not *A*." If *A* is the theory and *B* is the hypothesis ("if *A* then *B*"), then disconfirming the hypothesis ("not *B*") must mean that the theory is incorrect ("not *A*"). In practice, however, scientists do not give up on their theories so easily. One reason is that one disconfirmed hypothesis could be a missed opportunity (the result of a Type II error) or it could be the result of a faulty research design. Perhaps the researcher did not successfully manipulate the independent variable or measure the dependent variable.

A disconfirmed hypothesis could also mean that some unstated but relatively minor assumption of the theory was not met. For example, if Zajonc had failed to find social facilitation in cockroaches, he could have concluded that drive theory is still correct but it applies only to animals with sufficiently complex nervous systems. That is, the evidence from a study can be used to modify a theory. This practice does not mean that researchers are free to ignore disconfirmations of their theories. If they cannot improve their research designs or modify their theories to account for repeated disconfirmations, then they eventually must abandon their theories and replace them with ones that are more successful.

The bottom line here is that because statistics are probabilistic in nature and because all research studies have flaws, there is no such thing as scientific proof, there is only scientific evidence.

Reporting the Results

The final step in the research process involves reporting the results. As described in the section on Reviewing the Research Literature in this chapter, results are typically reported in peer-reviewed journal articles and at conferences.

The most prestigious way to report one's findings is by writing a manuscript and having it published in a peer-reviewed scientific journal. Manuscripts published in psychology journals typically must adhere to the writing style of the American Psychological Association (APA style). You will likely be learning the major elements of this writing style in this course.

Another way to report findings is by writing a book chapter that is published in an edited book. Preferably the editor of the book puts the chapter through peer review, but this is not always the case, and some scientists are invited by editors to write book chapters.

A fun way to disseminate findings is to give a presentation at a conference. This can either be done as an oral presentation or a poster presentation. Oral presentations involve getting up in front of an audience of fellow scientists and giving a talk that might last anywhere from 10 minutes to 1 hour (depending on the conference) and then fielding questions from the audience. Alternatively, poster presentations involve summarizing the study on a large poster that provides a brief overview of the purpose, methods, results, and discussion. The presenter stands by their poster for an hour or two and discusses it with people who pass by. Presenting one's work at a conference is a great way to get feedback from one's peers before attempting to undergo the more rigorous peer-review process involved in publishing a journal article.

KEY TAKEAWAYS

- Research in psychology can be described by a simple cyclical model. A research question based on the research literature leads to an empirical study, the results of which are published and become part of the research literature.
- The research literature in psychology is all the published research in psychology, consisting primarily of articles in professional journals and scholarly books.
- Early in the research process, it is important to conduct a review of the research literature on your topic to refine your research question, identify appropriate research methods, place your question in the context of other research, and prepare to write an effective research report.
- There are several strategies for finding previous research on your topic. Among the best is using APA PsycINFO, a computer database that catalogs millions of articles, books, and book chapters in psychology and related fields.
- Research questions expressed in terms of variables and relationships between variables can be suggested by other researchers or

generated by asking a series of more general questions about the behavior or psychological characteristic of interest.

- It is important to evaluate how interesting a research question is before designing a study and collecting data to answer it. Factors that affect interestingness are the extent to which the answer is in doubt, whether it fills a gap in the research literature, and whether it has important practical implications.
- It is also important to evaluate how feasible a research question will be to answer. Factors that affect feasibility include time, money, technical knowledge and skill, and access to special equipment and research participants.
- A theory is broad in nature and explains larger bodies of data. A hypothesis is more specific and makes a prediction about the outcome of a particular study.
- Working with theories is not "icing on the cake." It is a basic ingredient of psychological research.
- Like other scientists, psychologists use the hypothetico-deductive method. They construct theories to explain or interpret phenomena (or work with existing theories), derive hypotheses from their theories, test the hypotheses, and then reevaluate the theories in light of the new results.
- Variables vary across people or situations and may be quantitative (e.g., age) or categorical (e.g., course subject).
- A sample is a small subset of a larger population that is selected to participate in the research study. There are many different ways of sampling participants, including convenience sampling and simple random sampling.
- Experimental research involves manipulating an independent variable to observe the effects on a measured dependent variable, whereas non-experimental research involves measuring variables as they naturally occur (i.e., without manipulating anything).
- Research can be conducted in the field or the lab. Laboratory experiments tend to have high internal validity (allowing us to make strong causal conclusions), whereas field studies often have more external validity (allowing us to generalize to the real world).
- The mean, median, and mode are measures of central tendency used to describe the typical, average, or center scores in a distribution. The range, standard deviation, and variance are measures of how dispersed or spread apart the scores are. Measures of central tendency and dispersion are important descriptive statistics.
- Inferential statistics allow researchers to determine whether their findings are statistically significant, that is, whether they are unlikely to be due to chance alone and therefore are likely to represent a real effect in the population.
- Since statistics are probabilistic in nature, we never know if our conclusions are correct. We can make Type I errors (concluding an effect is real when it is not) or Type II errors (concluding there is no effect when there actually is a real effect in the population).
- Theories can be supported but not proved. Similarly, disconfirming a hypothesis does not necessarily mean that theory has been disproved.
- The final step of the research process involves reporting results at scientific conferences, in journal articles, and/or in books.

EXERCISES

1. Find a description of an empirical study in a professional journal or in one of the scientific psychology blogs. Then write a brief description of the research in terms of the cyclical model presented here. One or two sentences for each part of the cycle should suffice.
2. Watch this TED Ed video, in which David H. Schwartz provides an introduction to two types of empirical studies along with some methods that scientists use to increase the reliability of their results.
3. Use the techniques discussed in this chapter to find 10 journal articles and book chapters on one of the following research ideas: memory for smells, aggressive driving, the causes of narcissistic personality disorder, the functions of the intraparietal sulcus, or prejudice against the physically handicapped.
4. Watch this video clip produced by UBCiSchool about how to read an academic paper (without losing your mind).
5. Generate three research ideas based on each of the following: informal observations, practical problems, and topics discussed in recent issues of professional journals.
6. Generate an empirical research question about each of the following behaviors or psychological characteristics: long-distance running, getting tattooed, social anxiety, bullying, and memory for early childhood events.
7. Evaluate each of the research questions you generated in Exercise 6 in terms of its interestingness based on the criteria discussed in this chapter.
8. Find an issue of a journal that publishes short empirical research reports (e.g., *Psychological Science*, *Psychonomic Bulletin and Review*, *Personality and Social Psychology Bulletin*). Pick three studies, and rate each one in terms of how feasible it would be for you to replicate it with the resources available to you right now. Use the following rating scale: (1) You could replicate it essentially as reported. (2) You could replicate it with some simplifications. (3) You could not replicate it. Explain each rating.
9. Find a recent empirical research report in a professional journal. Read the introduction and highlight in different colors descriptions of theories and hypotheses.
10. Using the research article you found in a professional journal identify whether the study was experimental or non-experimental. If it was experimental, identify the independent and dependent variables.
11. Using the research article you found in a professional journal, identify which descriptive statistics were reported.
12. Describe why theories can be supported but not proved.

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READING 4

Research Designs

Christie Napa Scollon

SOURCE

Scollon, C. N. (2020). Research designs. In R. Biswas-Diener & E. Diener (Eds.), *Noba textbook series: Psychology.* DEF Publishers. http://noba.to/acxb2thy

LEARNING OBJECTIVES

- Articulate the difference between correlational and experimental designs.
- Understand how to interpret correlations.
- Understand how experiments help us to infer causality.
- Understand how surveys relate to correlational and experimental research.
- Explain what a longitudinal study is.
- List a strength and weakness of different research designs.

KEY TERMS

confounds
correlation
dependent variable
experimenter expectations
independent variable
longitudinal study
operational definitions
participant demand
placebo effect
quasi-experimental design
random assignment

Psychologists test research questions using a variety of methods. Most research relies on either correlations or experiments. With correlations, researchers measure variables as they naturally occur in people and compute the degree to which two variables go together. With experiments, researchers actively make changes in one variable and watch for changes in another variable. Experiments allow researchers to make causal inferences. Other types of methods include longitudinal and quasi-experimental designs. Many factors, including practical constraints, determine the type of methods researchers use. Often researchers survey people even though it would be better—but more expensive and time consuming—to track them longitudinally.

RESEARCH DESIGNS

In the early 1970s, a man named Uri Geller tricked the world: he convinced hundreds of thousands of people that he could bend spoons and slow watches using only the power of his mind. In fact, if you were in the audience, you would have likely believed he had psychic powers. Everything looked authentic—this man had to have paranormal abilities! So, why have you probably never heard of him before? Because when Uri was asked to perform his miracles in line with scientific experimentation, he was no longer able to do them. That is, even though it seemed like he was doing the impossible, when he was tested by science, he proved to be nothing more than a clever magician.

When we look at dinosaur bones to make educated guesses about extinct life, or systematically chart the heavens to learn about the relationships between stars and planets, or study magicians to figure out how they perform their tricks, we are forming observations—the foundation of science. Although we are all familiar with the saying "seeing is believing," conducting science is more than just what your eyes perceive. Science is the result of systematic and intentional study of the natural world. And psychology is no different. In the movie *Jerry Maguire*, Cuba Gooding Jr. became famous for using the phrase, "Show me the money!" In psychology, as in all sciences, we might say, "Show me the data!"

One of the important steps in scientific inquiry is to test our research questions, otherwise known as hypotheses. However, there are many ways to test hypotheses in psychological research. Which method you choose will depend on the type of questions you are asking, as well as what resources are available to you. All methods have limitations, which is why the best research uses a variety of methods.

Most psychological research can be divided into two types: experimental and correlational research.

EXPERIMENTAL RESEARCH

If somebody gave you $20 that absolutely had to be spent today, how would you choose to spend it? Would you spend it on an item you've been eyeing for weeks, or would you donate the money to charity? Which option do you think would bring you

At the Corner Perk Cafe, customers routinely pay for the drinks of strangers. Is this the way to get the most happiness out of a cup of coffee? Elizabeth Dunn's (2008) research shows that spending money on others may affect our happiness differently than spending money on ourselves. ["Two pretty nice cappuccinos" by Martin Westin/Flickr is licensed under CC BY-NC-ND 2.0.]

the most happiness? If you're like most people, you'd choose to spend the money on yourself (duh, right?). Our intuition is that we'd be happier if we spent the money on ourselves.

Knowing that our intuition can sometimes be wrong, Professor Elizabeth Dunn (2008) at the University of British Columbia set out to conduct an experiment on spending and happiness. She gave each of the participants in her experiment $20 and then told them they had to spend the money by the end of the day. Some of the participants were told they must spend the money on themselves, and some were told they must spend the money on others (either charity or a gift for someone). At the end of the day she measured participants' levels of happiness using a self-report questionnaire. (But wait, how do you measure something like happiness when you can't really see it? Psychologists measure many abstract concepts, such as happiness and intelligence, by beginning with **operational definitions** of the concepts. See the Noba modules on Intelligence and Happiness for more information on specific measurement strategies.)

In an experiment, researchers manipulate, or cause changes, in the **independent variable** and observe or measure any impact of those changes in the **dependent variable**. The independent variable is the one under the experimenter's control, or the variable that is intentionally altered between groups. In the case of Dunn's experiment, the independent variable was whether participants spent the money on themselves or on others. The dependent variable is the variable that is not manipulated at all, or the one where the effect happens. One way to help remember this is that the dependent variable "depends" on what happens to the independent variable. In our example, the participants' happiness (the dependent variable in this experiment) depends on how the participants spend their money (the independent variable). Thus, any observed changes or group differences in happiness can be attributed to whom the money was spent on. What Dunn and her colleagues found was that, after all the spending had been done, the people who had spent the money on others were happier than those who had spent the money on themselves. In other words, spending on others causes us to be happier than spending on ourselves. Do you find this surprising?

But wait! Doesn't happiness depend on a lot of different factors—for instance, a person's upbringing or life circumstances? What if some people had happy childhoods and that's why they're happier? Or what if some people dropped their toast that morning and it fell jam-side down and ruined their whole day? It is correct to recognize that these factors and many more can easily affect a person's level of happiness. So how can we accurately conclude that spending money on others causes happiness, as in the case of Dunn's experiment?

The most important thing about experiments is **random assignment**. Participants don't get to pick which condition they are in (e.g., participants didn't choose whether they were supposed to spend the money on themselves versus others). The experimenter assigns them to a particular condition based on the flip of a coin or the roll of a die or any other random method. Why do researchers do this? With Dunn's study, there is the obvious reason: you can imagine which condition most people would choose to be in, if given the choice. But another equally important reason is that random assignment makes it so the groups, on average, are similar on all characteristics except what the experimenter manipulates.

By randomly assigning people to conditions (self-spending versus other-spending), some people with happy childhoods should end up in each condition. Likewise, some people who had dropped their toast that morning (or experienced some other disappointment) should end up in each condition. As a result, the distribution of all these factors will generally be consistent across the two groups, and this means that on average the two groups will be relatively equivalent on all these factors. Random assignment is critical to experimentation because if the only difference between the two groups is the independent variable, we can infer that the independent variable is the cause of any observable difference (e.g., in the amount of happiness they feel at the end of the day).

Here's another example of the importance of random assignment: Let's say your class is going to form two basketball teams, and you get to be the captain of one team. The class is to be divided evenly between the two teams. If you get to pick the players for your team first, whom will you pick? You'll probably pick the tallest members of the class or the most athletic. You probably won't pick the short, uncoordinated people, unless there are no other options. As a result, your team will be taller and more athletic than the other team.

But what if we want the teams to be fair? How can we do this when we have people of varying height and ability? All we have to do is randomly assign players to the two teams. Most likely, some tall and some short people will end up on your team, and some tall and some short people will end up on the other team. The average height of the teams will be approximately the same. That is the power of random assignment!

Other Considerations

In addition to using random assignment, you should avoid introducing confounds into your experiments. **Confounds** are things that could undermine your ability to draw causal inferences. For example, if you wanted to test if a new happy pill will make people happier, you could randomly assign participants to take the happy pill or not (the independent variable) and compare these two groups on their self-reported happiness (the dependent variable). However, if some participants know they are getting the happy pill, they might develop expectations that influence their self-reported happiness. This is sometimes known as a **placebo effect**. Sometimes a person's knowledge that he or she is receiving special treatment or something new is enough to actually cause changes in behavior or perception: In other words, even if the participants in the happy pill condition were to report being happier, we wouldn't know if the pill was actually making them happier or if it was the placebo effect—an example of a confound. A related idea is **participant demand**. This occurs when participants try to behave in a way they think the experimenter wants them to behave. Placebo effects and participant demand often occur unintentionally. Even **experimenter expectations** can influence the outcome of a study. For example, if the experimenter knows who took the happy pill and who did not, and the dependent variable is the experimenter's observations of people's happiness, then the experimenter might perceive improvements in the happy pill group that are not really there.

One way to prevent these confounds from affecting the results of a study is to use a double-blind procedure. In a double-blind procedure, neither the participant nor the experimenter knows which condition the participant is in. For example, when participants are given the happy pill or the fake pill, they don't know which one they are receiving. This way the participants shouldn't experience the placebo effect and will be unable to behave as the researcher expects (participant demand). Likewise, the researcher doesn't know which pill each participant is taking (at least in the beginning—later, the researcher will get the results for data-analysis purposes), which means the researcher's expectations can't influence his or her observations. Therefore, because both parties are "blind" to the condition, neither will be able to behave in a way that introduces a confound. At the end of the day, the only difference between groups will be which pills the participants received, allowing the researcher to determine if the happy pill actually caused people to be happier.

CORRELATIONAL DESIGNS

When scientists passively observe and measure phenomena it is called correlational research. Here, we do not intervene and change behavior, as we do in experiments. In correlational research, we identify patterns of relationships, but we usually cannot infer what causes what. Importantly, with correlational research, you can examine only two variables at a time, no more and no less.

So, what if you wanted to test whether spending on others is related to happiness, but you don't have $20 to give to each participant? You could use a correlational design—which is exactly what Professor Dunn did, too. She asked people how much of their income they spent on others or donated to charity, and later she asked them how happy they were. Do you think these two variables were related? Yes, they were! The more money people reported spending on others, the happier they were.

More Details about the Correlation

To find out how well two variables correspond, we can plot the relation between the two scores on what is known as a scatterplot (FIGURE 4.1). In the scatterplot, each dot represents a data point. (In this case it's individuals, but it could be some

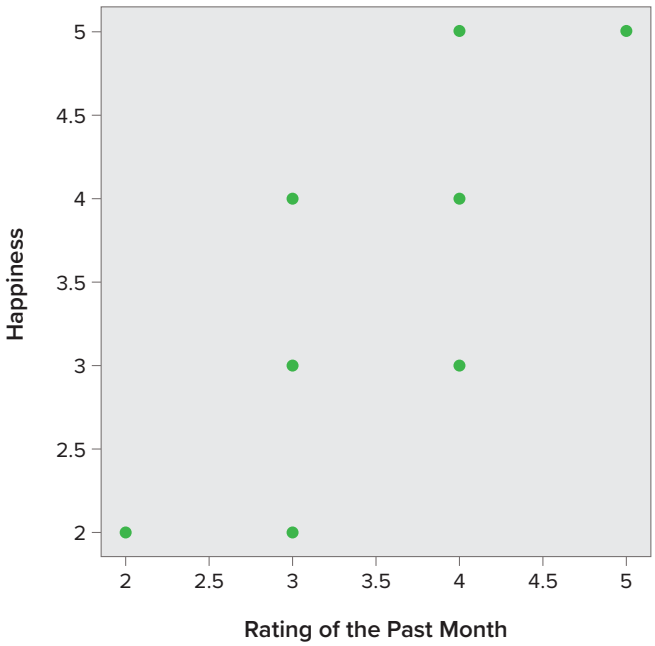

FIGURE 4.1. Scatterplot of the association between happiness and ratings of the past month, a positive correlation (r = .81). Each dot represents an individual. [This work, "Happiness Scatterplot," is licensed under CC BY-SA 4.0 by Judy Schmitt. It is a derivative of "Figure 1" by Christie Napa Scollon/Noba, which is licensed under CC BY-NC-SA 4.0.]

other unit.) Importantly, each dot provides us with two pieces of information—in this case, information about how good the person rated the past month (*x*-axis) and how happy the person felt in the past month (*y*-axis). Which variable is plotted on which axis does not matter.

The association between two variables can be summarized statistically using the correlation coefficient (abbreviated as *r*). A **correlation** coefficient provides information about the direction and strength of the association between two variables. For the example above, the direction of the association is positive. This means that people who perceived the past month as being good reported feeling more happy, whereas people who perceived the month as being bad reported feeling less happy.

With a positive correlation, the two variables go up or down together. In a scatterplot, the dots form a pattern that extends from the bottom left to the upper right (just as they do in **FIGURE 4.1**). The *r* value for a positive correlation is indicated by a positive number (although, the positive sign is usually omitted). Here, the *r* value is .81.

A negative correlation is one in which the two variables move in opposite directions. That is, as one variable goes up, the other goes down. **FIGURE 4.2** shows the association between the average height of males in a country (*y*-axis) and the pathogen prevalence, or commonness of disease (*x*-axis), of that country. In this scatterplot, each dot represents a country. Notice how the dots extend from the top left to the bottom right. What does this mean in real-world terms? It means that people are shorter in parts of the world where there is more disease. The *r* value for a negative correlation is indicated by a negative number—that is, it has a minus (−) sign in front of it. Here, it is −.83.

The strength of a correlation has to do with how well the two variables align. Recall that in Professor Dunn's correlational study, spending on others positively correlated with happiness: The more money people reported spending on others, the happier they reported being. At this point you may be thinking to yourself, *I know a very generous person who gave away lots of money to other people but is miserable!* Or maybe you know of a very stingy person who is happy as can be. Yes, there might be exceptions. If an association has many exceptions, it is considered a weak correlation. If an association has few or no exceptions, it is considered a strong correlation. A strong correlation is one in which the two variables always, or almost always, go together. In the example of happiness and how good the month has been, the association is strong. The stronger a correlation is, the tighter the dots in the scatterplot will be arranged along a sloped line.

The *r* value of a strong correlation will have a high absolute value. In other words, you disregard whether there is a negative sign in front of the *r* value and just consider the size of the numerical value itself. If the absolute value is large, it is a strong correlation. A weak correlation is one in which the two variables correspond some of the time, but not most of the time. **FIGURE 4.3** shows the relation between valuing happiness and grade point average (GPA). People who valued happiness more tended to earn slightly lower grades, but there were

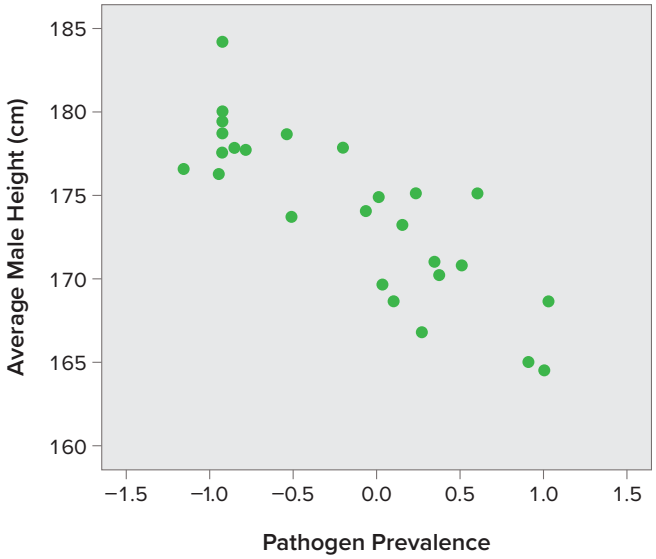

FIGURE 4.2. Scatterplot showing the association between average male height and pathogen prevalence, a negative correlation ($r = -.83$). Each dot represents a country. [This work, "Pathogen Scatterplot," is licensed under CC BY-SA 4.0 by Judy Schmitt. It is a derivative of "Figure 2" by Christie Napa Scollon/Noba, which is licensed under CC BY-NC-SA 4.0. Data from Chiao (2009).]

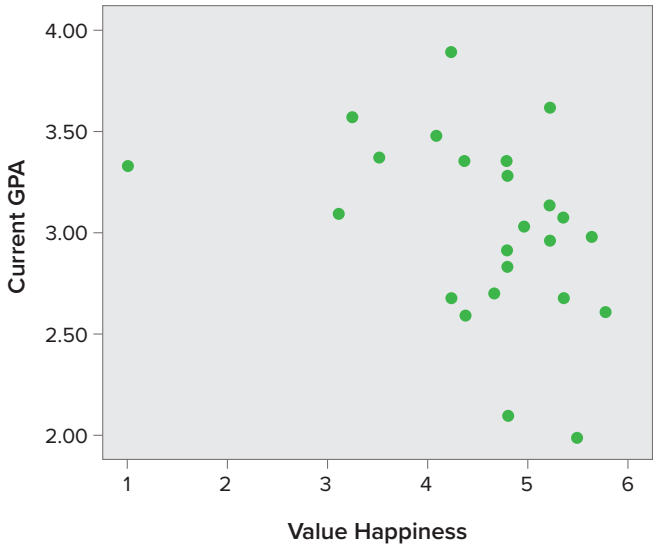

FIGURE 4.3. Scatterplot showing the association between valuing happiness and GPA, a weak negative correlation ($r = -.32$). Each dot represents an individual. [This work, "GPA-Happiness Scatterplot," is licensed under CC BY-SA 4.0 by Judy Schmitt. It is a derivative of "Figure 3" by Christie Napa Scollon/Noba, which is licensed under CC BY-NC-SA 4.0.]

lots of exceptions to this. The *r* value for a weak correlation will have a low absolute value. If two variables are so weakly related as to be unrelated, we say they are uncorrelated, and the *r* value will be zero or very close to zero. In the previous example, is the correlation between height and pathogen prevalence strong? Compared to **FIGURE 4.3**, the dots in **FIGURE 4.2** are tighter and less dispersed. The absolute value of –.83 is large. Therefore, it is a strong negative correlation.

Can you guess the strength and direction of the correlation between age and year of birth? If you said this is a strong negative correlation, you are correct! Older people always have lower years of birth than younger people (e.g., 1950 vs. 1995), but at the same time, the older people will have a higher age (e.g., 65 vs. 20). In fact, this is a perfect correlation because there are no exceptions to this pattern. I challenge you to find a 10-year-old born before 2010! You can't.

Problems with the Correlation

If generosity and happiness are positively correlated, should we conclude that being generous causes happiness? Similarly, if height and pathogen prevalence are negatively correlated, should we conclude that disease causes shortness? From a correlation alone, we can't be certain. For example, in the first case it may be that happiness causes generosity, or that generosity causes happiness. Or, a third variable might cause both happiness *and* generosity, creating the illusion of a direct link between the two. For example, wealth could be the third variable that causes both greater happiness and greater generosity. This is why correlation does not mean causation—an often repeated phrase among psychologists.

QUALITATIVE DESIGNS

Just as correlational research allows us to study topics we can't experimentally manipulate (e.g., whether you have a large or small income), there are other types of research designs that allow us to investigate these harder-to-study topics. Qualitative designs, including participant observation, case studies, and narrative analysis are examples of such methodologies. Although something as simple as "observation" may seem like it would be a part of all research methods, participant observation is a distinct methodology that involves the researcher embedding himself or herself into a group in order to study its dynamics. For example, Festinger et al. (1956) were very interested in the psychology of a particular cult. However, this cult was very secretive and wouldn't grant interviews to outsiders. So, in order to study these people, Festinger and his colleagues pretended to be cult members, allowing them access to the behavior and psychology of the cult. Despite this example, it should be noted that the people being observed in a participant observation study usually know that the researcher is there to study them.

Another qualitative method for research is the case study, which involves an intensive examination of specific individuals or specific contexts. Sigmund Freud, the father of psychoanalysis, was famous for using this type of methodology; however, more current examples of case studies usually involve brain injuries. For instance, imagine that researchers want to know how a very specific brain injury affects people's experience of happiness. Obviously, the researchers can't conduct experimental research that involves inflicting this type of injury on people. At the same time, there are too few people who have this type of injury to conduct correlational research. In such an instance, the researcher may examine only one person with this brain injury, but in doing so, the researcher will put the participant through a very extensive round of tests. Hopefully, what is learned from this one person can be applied to others; however, even with thorough tests, there is the chance that something unique about this individual (other than the brain injury) will affect his or her happiness. But with such a limited number of possible participants, a case study is really the only type of methodology suitable for researching this brain injury.

The final qualitative method to be discussed in this section is narrative analysis. Narrative analysis centers around the study of stories and personal accounts of people, groups, or cultures. In this methodology, rather than engaging with participants directly, or quantifying their responses or behaviors, researchers will analyze the themes, structure, and dialogue of each person's narrative. That is, a researcher will examine people's personal testimonies in order to learn more about the psychology of those individuals or groups. These stories may be written, audio-recorded, or video-recorded and allow the researcher not only to study *what* the participant says but *how* he or she says it. Every person has a unique perspective on the world, and studying the way he or she conveys a story can provide insight into that perspective.

QUASI-EXPERIMENTAL DESIGNS

What if you want to study the effects of marriage on a variable? For example, does marriage make people happier? Can you randomly assign some people to get married and others to remain single? Of course not. So how can you study these important variables? You can use a **quasi-experimental design**.

A quasi-experimental design is similar to experimental research, except that random assignment to conditions is not used. Instead, we rely on existing group memberships (e.g., married vs. single). We treat these as the independent variables, even though we don't assign people to the conditions and don't manipulate the variables. As a result, with quasi-experimental designs causal inference is more difficult. For example, married people might differ from unmarried people on a variety of characteristics. If we find that married

What is a reasonable way to study the effects of marriage on happiness? ["Love" by Ted Murphy/Flickr is licensed under CC BY 2.0.]

participants are happier than single participants, it will be hard to say that marriage causes happiness, because the people who got married might have already been happier than the people who have remained single.

Because experimental and quasi-experimental designs can seem pretty similar, let's use another example to distinguish them. Imagine you want to know who is a better professor: Dr. Smith or Dr. Khan. To judge their ability, you're going to look at their students' final grades. Here, the independent variable is the professor (Dr. Smith vs. Dr. Khan) and the dependent variable is the students' grades. In an experimental design, you would randomly assign students to one of the two professors and then compare the students' final grades. However, in real life, researchers can't randomly force students to take one professor over the other; instead, the researchers would just have to use the preexisting classes and study them as-is (quasi-experimental design). Again, the key difference is random assignment to the conditions of the independent variable. Although the quasi-experimental design (where the students choose which professor they want) may seem random, it's most likely not. For example, maybe students heard Dr. Smith sets low expectations, so slackers prefer this class, whereas Dr. Khan sets higher expectations, so smarter students prefer that one. This now introduces a confounding variable (student intelligence) that will almost certainly have an effect on students' final grades, regardless of how skilled the professor is. So, even though a quasi-experimental design is similar to an experimental design (i.e., it has a manipulated independent variable), because there's no random assignment, you can't reasonably draw the same conclusions that you would with an experimental design.

LONGITUDINAL STUDIES

Another powerful research design is the **longitudinal study**. Longitudinal studies track the same people over time. Some longitudinal studies last a few weeks, some a few months, some a year or more. Some studies that have contributed a lot to psychology followed the same people over decades. For example, one study followed more than 20,000 Germans for two decades. From these longitudinal data, psychologist Rich Lucas (2003) was able to determine that people who end up getting married indeed start off a bit happier than their peers who never marry. Longitudinal studies like this provide valuable evidence for testing many theories in psychology, but they can be quite costly to conduct, especially if they follow many people for many years.

SURVEYS

A survey is a way of gathering information using old-fashioned questionnaires or the Internet. Compared to a study conducted in a psychology laboratory, surveys can reach a larger number of participants at a much lower cost. Although surveys are typically used for correlational research, this is not always the case. An experiment can be carried out using surveys as well. For example, King and Napa (1998) presented participants with different types of stimuli on paper: either a survey completed by a happy person or a survey completed by an unhappy person. They wanted to see whether happy people were judged as more likely to get into heaven compared to unhappy people. Can you figure out the independent and dependent variables in this study? Can you guess what the results were? Happy people (vs. unhappy people; the independent variable) were judged as more likely to go to heaven (the dependent variable) compared to unhappy people!

Likewise, correlational research can be conducted without the use of surveys. For instance, psychologists LeeAnn Harker and Dacher Keltner (2001) examined the smile intensity

Surveys provide researchers with some significant advantages in gathering data. They make it possible to reach large numbers of people while keeping costs to the researchers and the time commitments of participants relatively low. ["Woman Filling Up The Documents in the Office" by Marco Verch/Flickr is licensed under CC BY 2.0.]

of women's college yearbook photos. Smiling in the photos was correlated with being married 10 years later!

TRADEOFFS IN RESEARCH

Even though there are serious limitations to correlational and quasi-experimental research, they are not poor cousins to experiments and longitudinal designs. In addition to selecting a method that is appropriate to the question, many practical concerns may influence the decision to use one method over another. One of these factors is simply resource availability—how much time and money do you have to invest in the research? (Tip: If you're doing a senior honor's thesis, do not embark on a lengthy longitudinal study unless you are prepared to delay graduation!) Often, we survey people even though it would be more precise—but much more difficult—to track them longitudinally. Especially in the case of exploratory research, it may make sense to opt for a cheaper and faster method first. Then, if results from the initial study are promising, the researcher can follow up with a more intensive method.

Beyond these practical concerns, another consideration in selecting a research design is the ethics of the study. For example, in cases of brain injury or other neurological abnormalities, it would be unethical for researchers to inflict these impairments on healthy participants. Nonetheless, studying people with these injuries can provide great insight into human psychology (e.g., if we learn that damage to a particular region of the brain interferes with emotions, we may be able to develop treatments for emotional irregularities). In addition to brain injuries, there are numerous other areas of research that could be useful in understanding the human mind but that pose challenges to a true experimental design—such as the experiences of war, long-term isolation, abusive parenting, or prolonged drug use. However, none of these are conditions we could ethically experimentally manipulate and randomly assign people to. Therefore, ethical considerations are another crucial factor in determining an appropriate research design.

RESEARCH METHODS: WHY YOU NEED THEM

Just look at any major news outlet and you'll find research routinely being reported. Sometimes the journalist understands the research methodology, sometimes not (e.g., correlational evidence is often incorrectly represented as causal evidence). Often, the media are quick to draw a conclusion for you. After reading this module, you should recognize that the strength of a scientific finding lies in the strength of its methodology. Therefore, in order to be a savvy consumer of research, you need to understand the pros and cons of different methods and the distinctions among them. Plus, understanding how psychologists systematically go about answering research questions will help you to solve problems in other domains, both personal and professional, not just in psychology.

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READING 5

Thinking like a Psychological Scientist

Erin I. Smith

SOURCE

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LEARNING OBJECTIVES

- Compare and contrast conclusions based on scientific and everyday inductive reasoning.
- Understand why scientific conclusions and theories are trustworthy, even if they are not able to be proven.
- Articulate what it means to think like a psychological scientist, considering qualities of good scientific explanations and theories.
- Discuss science as a social activity, comparing and contrasting facts and values.

KEY TERMS

anecdotal evidence
causality
correlation
data
deductive reasoning
distribution
empirically
facts
falsified
generalize
hypotheses
induction
inductive reasoning
levels of analysis
null-hypothesis significance testing (NHST)
objective
population
probabilities
probability values
pseudoscience
representative
sample
scientific theory
Type I error
Type II error
values

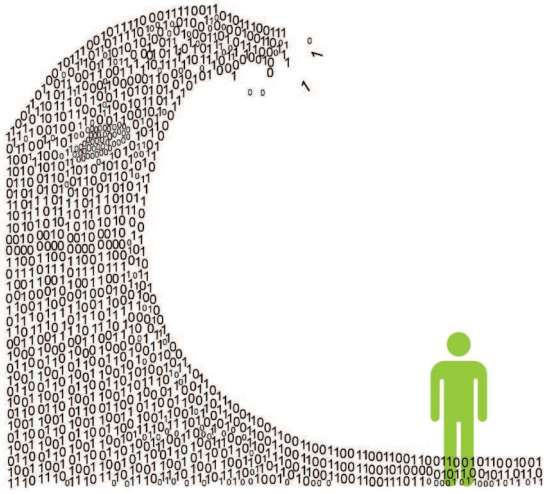
We are bombarded every day with claims about how the world works, claims that have a direct impact on how we think about and solve problems in society and our personal lives. This module explores important considerations for evaluating the trustworthiness of such claims by contrasting between scientific thinking and everyday observations (also known as "anecdotal evidence").

INTRODUCTION

Why are some people so much happier than others? Is it harmful for children to have imaginary companions? How might students study more effectively?

Even if you've never considered these questions before, you probably have some guesses about their answers. Maybe you think getting rich or falling in love leads to happiness. Perhaps you view imaginary friends as expressions of a dangerous lack of realism. What's more, if you were to ask your friends, they would probably also have opinions about these questions—opinions that may even differ from your own.

A quick internet search would yield even more answers. We live in the "Information Age," with people having access to more explanations and answers than at any other time in history. But, although the *quantity* of information is continually increasing, it's always good practice to consider the *quality* of what you read or watch: Not all information is equally trustworthy. The trustworthiness of information is especially



Today, people are overwhelmed with information, although it varies in quality. ["Social Media Information Overload" by Mark Smiciklas/Flickr is licensed under CC BY-NC 2.0.]

important in an era when "fake news," urban myths, misleading "click-bait," and conspiracy theories compete for our attention alongside well-informed conclusions grounded in evidence. Determining what information is well-informed is a crucial concern and a central task of science. Science is a way of using observable **data** to help explain and understand the world around us in a trustworthy way.

In this module, you will learn about scientific thinking. You will come to understand how scientific research informs our knowledge and helps us create theories. You will also come to appreciate how scientific reasoning is different from the types of reasoning people often use to form personal opinions.

SCIENTIFIC VERSUS EVERYDAY REASONING

Each day, people offer statements as if they are facts, such as, "It looks like rain today," or, "Dogs are very loyal." These conclusions represent **hypotheses** about the world: best guesses as to how the world works. Scientists also draw conclusions, claiming things like, "There is an 80% chance of rain today," or, "Dogs tend to protect their human companions." You'll notice that the two examples of scientific claims use less certain language and are more likely to be associated with probabilities. Understanding the similarities and differences between scientific and everyday (non-scientific) statements is essential to our ability to accurately evaluate the trustworthiness of various claims.

Scientific and everyday reasoning both employ **induction**: drawing general conclusions from specific observations. For example, a person's opinion that cramming for a test increases performance may be based on her memory of passing an exam after pulling an all-night study session. Similarly, a researcher's conclusion *against* cramming might be based on studies comparing the test performances of people who studied the material in different ways (e.g., cramming versus study sessions spaced out over time). In these scenarios, both scientific and everyday conclusions are drawn from a limited **sample** of potential observations.

The process of induction, alone, does not seem suitable enough to provide trustworthy information, given the contradictory results. What should a student who wants to perform well on exams do? One source of information encourages her to cram, while another suggests that spacing out her studying time is the best strategy. To make the best decision with the information at hand, we need to appreciate the differences between personal opinions and scientific statements, which requires an understanding of science and the nature of scientific reasoning.

There are generally agreed-upon features that distinguish scientific thinking—and the theories and data generated by it—from everyday thinking. A short list of some of the commonly cited features of scientific theories and data is shown in TABLE 5.1.

One additional feature of modern science not included in this list but prevalent in scientists' thinking and theorizing is falsifiability, a feature that has so permeated scientific practice that it warrants additional clarification. In the early twentieth century, Karl Popper (1902–1994) suggested that science can be distinguished from **pseudoscience** (or just everyday reasoning) because scientific claims are capable of being **falsified**. That is, a claim can be conceivably demonstrated to be untrue. For example, a person might claim that "all people are right handed." This claim can be tested and—ultimately—thrown

TABLE 5.1. Features of Good Scientific Theories

Feature	Description	Example
Accuracy	Explanations and theories match real-world observations	Although people say, "opposites attract," theories that focus on the role of partner similarity do a better job of explaining the observed data
Consistency	A theory has few exceptions and shows agreement with other theories within and across disciplines.	The theory of evolution explains many findings across biology and psychology predicting, for example, that humans are better able to solve problems presented in concrete rather than abstract terms
Scope	Extent to which a theory extends beyond currently available data, explaining a wide array of phenomena.	There is a theory that people use mental "short cuts" when making decisions rather than weighing every single piece of evidence. This can be seen in consumer purchasing behavior, in romantic relationships, in charitable donations, and in health choices.
Simplicity	When multiple explanations are equally good at explaining the data, the simplest should be selected.	The simplest explanation for why "good" people sometimes do "bad" things is because they succumb to some outside influence
Fruitfulness	The usefulness of the theory in guiding new research by predicting new, testable relationships.	The explanation that competition leads to improved performance can be tested by researching different types of competition

From Kuhn (2011).

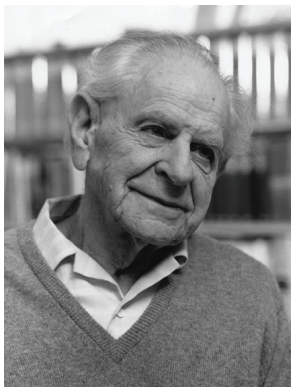
out because it can be shown to be false: There are people who are left-handed. An easy rule of thumb is to not get confused by the term *falsifiable* but to understand that—more or less—it means testable.

On the other hand, some claims cannot be tested and falsified. Imagine, for instance, that a magician claims that he can teach people to move objects with their minds. The trick, he explains, is to *truly believe* in one's ability for it to work. When his students fail to budge chairs with their minds, the magician scolds, "Obviously, you don't truly believe." The magician's claim does not qualify as falsifiable because there is no way to disprove it. It is unscientific.

Popper was particularly irritated about nonscientific claims because he believed they were a threat to the science of psychology. Specifically, he was dissatisfied with Freud's explanations for mental illness. Freud believed that when a person suffers a mental illness it is often due to problems stemming from childhood. For instance, imagine a person who grows up to be an obsessive perfectionist. If she was raised by messy, relaxed parents, Freud might argue that her adult perfectionism is a reaction to her early family experiences—an effort to maintain order and routine instead of chaos. Alternatively, imagine the same person being raised by harsh, orderly parents. In this case, Freud might argue that her adult tidiness is simply her internalizing her parents' way of being. As you can see, according to Freud's rationale, both opposing scenarios are possible; no matter what the disorder, Freud's theory could explain its childhood origin—thus failing to meet the principle of falsifiability.

Popper argued against statements that could not be falsified. He claimed that they blocked scientific progress: There was no way to advance, refine, or refute knowledge based on such claims. Popper's solution was a powerful one: *If science showed all the possibilities that were not true, we would be left only with what is true.* That is, we need to be able to articulate—beforehand—the kinds of evidence that will disprove our hypothesis and cause us to abandon it.

This may seem counterintuitive. For example, if a scientist wanted to establish a comprehensive understanding of why car accidents happen, she would systematically test all potential causes: alcohol consumption, speeding, using a cell phone, fiddling with the radio, wearing sandals, eating, chatting with a passenger, etc. A complete understanding could only be achieved once all possible explanations were explored and either falsified or not. After all the testing was concluded, the evidence would be evaluated against the criteria for falsification, and only the real causes of accidents would remain. The scientist could dismiss certain claims (e.g., sandals lead to car accidents) and keep only those supported by research (e.g., using a mobile phone while driving increases risk). It might seem absurd that a scientist would need to investigate so many alternative explanations, but it is exactly how we rule out bad claims. Of course, many explanations are complicated and involve multiple causes—as with car accidents, as well as psychological phenomena.



Karl Popper was an influential thinker regarding scientific theory and reasoning. ["Karl Popper in 1990" by Lucinda Douglas-Menzies/Wikimedia Commons; no known copyright restrictions exist.]

TEST YOURSELF 1: CAN IT BE FALSIFIED?

Which of the following hypotheses can be falsified? For each, be sure to consider what kind of data could be collected to demonstrate that a statement is not true.

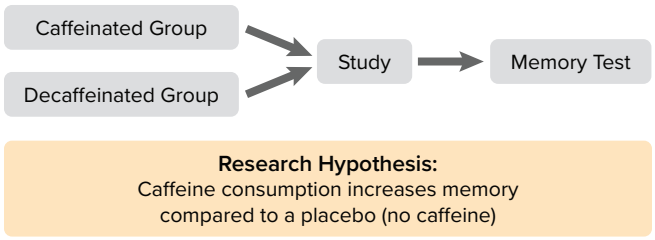
A. Chocolate tastes better than pasta.
B. We live in the most violent time in history.
C. Time can run backward as well as forward.
D. There are planets other than Earth that have water on them.

[See answer at end of this module.]

Although the idea of falsification remains central to scientific data and theory development, these days it's not used strictly the way Popper originally envisioned it. To begin with, scientists aren't solely interested in demonstrating what *isn't.* Scientists are also interested in providing descriptions and explanations for the way things *are*. We want to describe different causes and the various conditions under which they occur. We want to discover when young children start speaking in complete sentences, for example, or whether people are happier on the weekend, or how exercise impacts depression. These explorations require us to draw conclusions from limited samples of data. In some cases, these data seem to fit with our hypotheses and in others they do not. This is where interpretation and probability come in.

THE INTERPRETATION OF RESEARCH RESULTS

Imagine a researcher wanting to examine the hypothesis—a specific prediction based on previous research or scientific theory—that caffeine enhances memory. She knows there are several published studies that suggest this might be the case, and she wants to further explore the possibility. She designs an experiment to test this hypothesis. She randomly assigns some participants a cup of fully caffeinated tea and some a cup of herbal tea. All the participants are instructed to drink up, study a list of words, then complete a memory test. There are three possible outcomes of this proposed study:



1. The caffeine group performs better (support for the hypothesis).
2. The no-caffeine group performs better (evidence against the hypothesis).
3. There is no difference in the performance between the two groups (also evidence against the hypothesis).

Let's look, from a scientific point of view, at how the researcher should interpret each of these three possibilities.

First, if the results of the memory test reveal that the caffeine group performs better, this is a piece of evidence in favor of the hypothesis: It appears, at least in this case, that caffeine is associated with better memory. It does not, however, *prove* that caffeine is associated with better memory. There are still many questions left unanswered. How long does the memory boost last? Does caffeine work the same way with people of all ages? Is there a difference in memory performance between people who drink caffeine regularly and those who never drink it? Could the results be a freak occurrence? Because of these uncertainties, we do not say that a study—especially a single study—*proves* a hypothesis. Instead, we say the results of the study offer evidence in support of the hypothesis. Even if we tested this across 10 thousand or 100 thousand people, we still could not use the word *proven* to describe this phenomenon. This is because inductive reasoning is based on **probabilities**. Probabilities are always a matter of degree; they may be extremely likely or unlikely. Science is better at shedding light on the likelihood—or probability—of something than at proving it. In this way, data are still highly useful even if they doesn't fit Popper's absolute standards.

The science of meteorology helps illustrate this point. You might look at your local weather forecast and see a high likelihood of rain. This is because the meteorologist has used **inductive reasoning** to create her forecast. She has taken current observations—lots of dense clouds coming toward your city—and compared them to historical weather patterns associated with rain, making a reasonable prediction of a high probability of rain. The meteorologist has not *proven* it will rain, however, by pointing out the oncoming clouds.

Proof is more associated with deductive reasoning. **Deductive reasoning** starts with general principles that are applied to specific instances (the reverse of inductive reasoning). When the general principles, or *premises*, are true, and the structure of the argument is valid, the conclusion is, by definition, *proven;* it must be so. A deductive truth *must* apply in all relevant circumstances. For example, all living cells contain DNA. From this, you can reason—deductively—that any specific living cell (of an elephant, or a person, or a snake) will therefore contain DNA. Given the complexity of psychological phenomena, which involve many contributing factors, it is nearly impossible to make these types of broad statements with certainty.

TEST YOURSELF 2: INDUCTIVE OR DEDUCTIVE?

(1) The stove was on, and the water in the pot was boiling over. The front door was standing open. These clues suggest the homeowner left unexpectedly and in a hurry.
(2) Gravity is associated with mass. Because the moon has a smaller mass than the Earth, it should have weaker gravity.
(3) Students don't like to pay for high-priced textbooks. It is likely that many students in the class will opt not to purchase a book.
(4) To earn a college degree, students need 100 credits. Janine has 85 credits, so she cannot graduate.

[See answer at end of this module.]

The second possible result from the caffeine-memory study is that the group who had *no* caffeine demonstrates better memory. This result is the opposite of what the researcher expects to find (her hypothesis). Here, the researcher must admit the evidence does not support her hypothesis. She must be careful, however, not to extend that interpretation to other claims. For example, finding increased memory in the no-caffeine group would not be evidence that caffeine harms memory. Again, there are too many unknowns. Is this finding a freak occurrence, perhaps based on an unusual sample? Is there a problem with the design of the study? The researcher doesn't know. She simply knows that she was not able to observe support for her hypothesis.

There is at least one additional consideration: The researcher originally developed her caffeine-benefits-memory hypothesis based on conclusions drawn from previous research. That is, previous studies found results that suggested caffeine boosts memory. The researcher's single study should not outweigh the conclusions of many studies. Perhaps the earlier research employed participants of different ages or who had different baseline levels of caffeine intake. This new study simply becomes a piece of fabric in the overall quilt of studies of the caffeine-memory relationship. It does not, on its own, definitively falsify the hypothesis.

Finally, it's possible that the results show no difference in memory between the two groups. How should the researcher interpret this? How would you? In this case, the researcher once again has to admit that she has not found support for her hypothesis.

Interpreting the results of a study—regardless of outcome—rests on the quality of the observations from which those results are drawn. If you learn, say, that each group in a study included only four participants, or that they were all over 90 years old, you might have concerns. Specifically, you should be concerned that the observations, even if accurate, aren't **representative** of the general population. This is one of the defining differences between conclusions drawn from personal anecdotes and those drawn from scientific observations. **Anecdotal evidence**—derived from personal experience and unsystematic observations (e.g., "common sense,")—is limited by the quality and representativeness of observations and by memory shortcomings. Well-designed research, on the other hand, relies on observations that are systematically recorded, of high quality, and representative of the **population** it claims to describe.

WHY SHOULD I TRUST SCIENCE IF IT CAN'T PROVE ANYTHING?

It's worth delving a bit deeper into why we ought to trust the scientific inductive process, even when it relies on limited samples that don't offer absolute "proof." To do this, let's examine a widespread practice in psychological science: null-hypothesis significance testing.

To understand this concept, let's begin with another research example. Imagine, for instance, a researcher is curious about the ways maturity affects academic performance. She might have a hypothesis that mature students are more likely to be responsible about studying and completing homework and, therefore, will do better in their courses. To test this hypothesis, the researcher needs a measure of maturity and a measure of course performance. She might calculate the **correlation**—or relationship—between student age (her measure of maturity) and points earned in a course (her measure of academic performance). Ultimately, the researcher is interested in the likelihood—or probability—that these two variables closely relate to one another. **Null-hypothesis significance testing (NHST)** assesses the probability that the collected data (the observations) would be the same if there were no relationship between the variables in the study. Using our example, the NHST would test the probability that the researcher would find a link between age and class performance if there were, in reality, no such link.

Is there a relationship between student age and academic performance? How could we research this question? How confident can we be that our observations reflect reality? ["Center for Teaching and Learning at UIS" by Jeremy Wilburn/Flickr is licensed under CC BY-NC-ND 2.0.]

Now, here's where it gets a little complicated. NHST involves a *null hypothesis,* a statement that two variables are *not* related (in this case, that student maturity and academic performance are *not* related in any meaningful way). NHST also involves an *alternative hypothesis,* a statement that two variables *are* related (in this case, that student maturity and academic performance go together). To evaluate these two hypotheses, the researcher collects data. The researcher then compares what she expects to find (probability) with what she actually finds (the collected data) to determine whether she can falsify, or reject, the null hypothesis in favor of the alternative hypothesis.

How does she do this? By looking at the **distribution** of the data. The distribution is the spread of values—in our example, the numeric values of students' scores in the course. The researcher will test her hypothesis by comparing the observed distribution of grades earned by older students to those earned by younger students, recognizing that some distributions are more or less likely. Your intuition tells you, for example, that the chances of every single person in the course getting a perfect score are lower than their scores being distributed across all levels of performance.

The researcher can use a probability table to assess the likelihood of any distribution she finds in her class. These tables reflect the work, over the past 200 years, of mathematicians and scientists from a variety of fields. You can see, in FIGURE 5.1(a), an example of an expected distribution if the grades were normally distributed (most are average, and relatively few are amazing or terrible). In FIGURE 5.1(b), you can see possible results of this imaginary study and can clearly see how they differ from the expected distribution.

In the process of testing these hypotheses, there are four possible outcomes. These are determined by two factors: (1) reality, and (2) what the researcher finds (see TABLE 5.2). The best possible outcome is *accurate detection*. This means that the researcher's conclusion mirrors reality. In our example, let's pretend the more mature students do perform slightly better. If this is what the researcher finds in her data, her analysis qualifies as an accurate detection of reality. Another form of accurate detection is when a researcher finds no evidence for a phenomenon, but that phenomenon doesn't actually

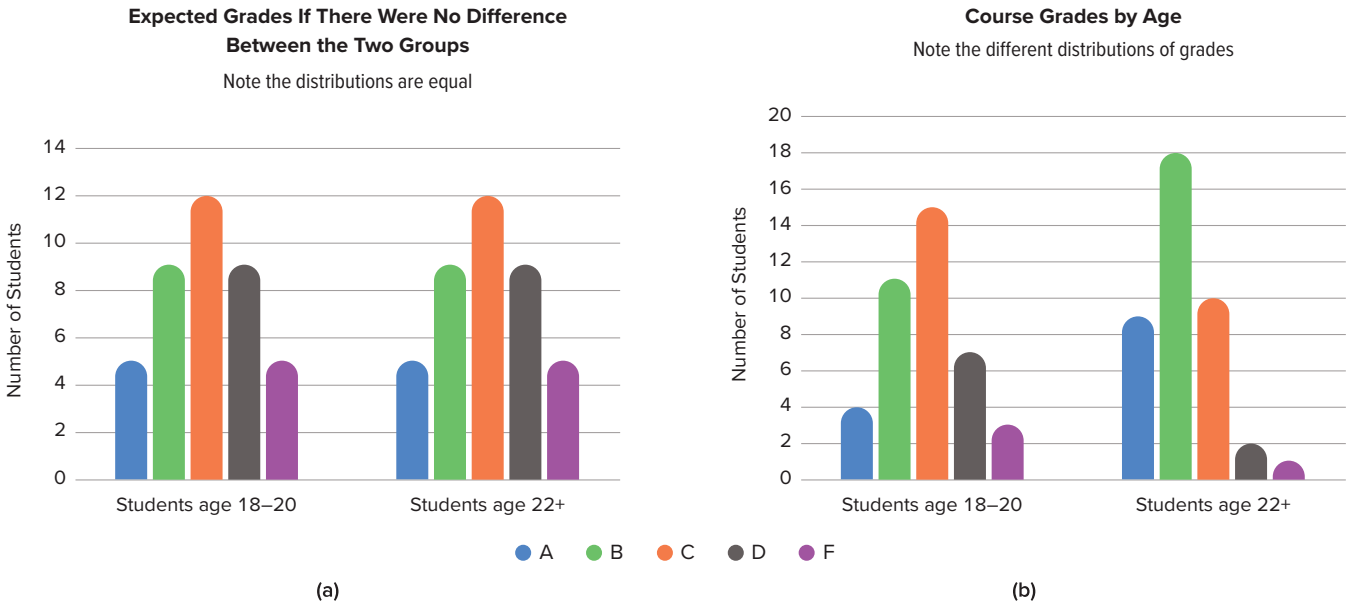


FIGURE 5.1. Distributions of grades in an imaginary study. (a) Expected grades if there were no difference between the two groups. (b) Actual course grades by age. [This work, "Grade Distributions," is licensed under CC BY-SA 4.0 by Judy Schmitt. It is a derivative of "Table 2" by Erin I. Smith/Noba, which is licensed under CC BY-NC-SA 4.0.]

exist anyway! Using this same example, let's now pretend that maturity has *nothing* to do with academic performance. Perhaps academic performance is instead related to intelligence or study habits. If the researcher finds no evidence for a link between maturity and grades and none actually exists, she will have also achieved accurate detection.

There are a couple of ways that research conclusions might be wrong. One is referred to as a **Type I error**—when the researcher concludes there *is* a relationship between two variables but, in reality, there is *not*. Back to our example: Let's now pretend there's no relationship between maturity and grades, but the researcher still finds one. Why does this happen? It may be that her sample, by chance, includes older students who *also* have better study habits and perform better: The researcher has "found" a relationship (the data appearing to show age as significantly correlated with academic performance), but the truth is that the apparent relationship is purely coincidental—the result of these specific older students in this particular sample having better-than-average study habits (the real cause of the relationship). They may have always had superior study habits, even when they were young.

Another possible outcome of NHST is a **Type II error**, when the data fail to show a relationship between variables that actually exists. In our example, this time pretend that maturity *is*—in reality—associated with academic performance, but the researcher *doesn't* find it in her sample. Perhaps it was just her bad luck that her older students are just having an off day, suffering from test anxiety, or were uncharacteristically careless with their homework: The peculiarities of her particular sample, by chance, prevent the researcher from identifying the real relationship between maturity and academic performance.

These types of errors might worry you, that there is just no way to tell if data are any good or not. Researchers share your concerns, and address them by using **probability values** (*p*-values) to set a threshold for Type I or Type II errors. When researchers write that a particular finding is "significant at a $p < .05$ level," they're saying that if the same study were repeated 100 times, we should expect this result to occur—by chance—fewer than five times. That is, in this case, a Type I error is unlikely. Scholars sometimes argue over the exact threshold that should be used for probability. The most common in psychological science are .05 (5% chance), .01 (1% chance), and .001 (1/10 of 1% chance). Remember, psychological science doesn't rely on definitive proof; it's about the probability of seeing a specific result. This is also why it's so important that scientific findings be replicated in additional studies.

TABLE 5.2. Accurate Detection and Errors in Research

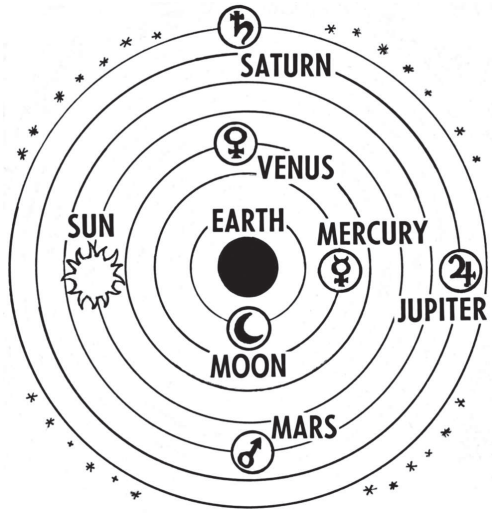
		In reality there is . . .	
		a relationship	**no relationship**
The researcher finds . . .	**a relationship** (alternative hypothesis)	Accurate detection!	**Type I error**
	no relationship (null hypothesis)	**Type II error**	Accurate detection!

It's because of such methodologies that science is generally trustworthy. Not all claims and explanations are equal; some conclusions are better bets, so to speak. Scientific claims are more likely to be correct and predict real outcomes than "common sense" opinions and personal anecdotes. This is because researchers consider how to best prepare and measure their subjects, systematically collect data from large and—ideally—representative samples, and test their findings against probability.

SCIENTIFIC THEORIES

The knowledge generated from research is organized according to scientific theories. A **scientific theory** is a comprehensive framework for making sense of evidence regarding a particular phenomenon. When scientists talk about a theory, they mean something different from how the term is used in everyday conversation. In common usage, a theory is an educated guess—as in, "I have a theory about which team will make the playoffs," or, "I have a theory about why my sister is always running late for appointments." Both of these beliefs are liable to be heavily influenced by many untrustworthy factors, such as personal opinions and memory biases. A scientific theory, however, enjoys support from many research studies, collectively providing evidence, including, but not limited to, that which has falsified competing explanations. A key component of good theories is that they describe, explain, and predict in a way that can be **empirically** tested and potentially falsified.

Theories are open to revision if new evidence comes to light that compels reexamination of the accumulated, relevant data. In ancient times, for instance, people thought the Sun traveled around the Earth. This seemed to make sense and fit with many observations. In the sixteenth century, however, astronomers began systematically charting visible objects in the sky, and, over a 50-year period, with repeated testing, critique, and refinement, they provided evidence for a revised theory: The Earth and other cosmic objects revolve around the Sun. In science, we believe what the best and most data tell us. If better data come along, we must be willing to change our views in accordance with the new evidence.



Early theories placed the Earth at the center of the solar system. We now know that the Earth revolves around the sun. ["Ptolemaic System 2" by Pearson Scott Foresman/Wikimedia Commons is in the public domain.]

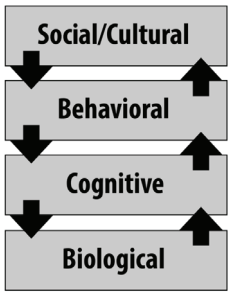
IS SCIENCE OBJECTIVE?

Thomas Kuhn (2012), a historian of science, argued that science, as an activity conducted by humans, is a social activity. As such, it is—according to Kuhn—subject to the same psychological influences as all human activities. Specifically, Kuhn suggested that there is no such thing as **objective** theory or data; all of science is informed by values. Scientists cannot help but let personal/cultural values, experiences, and opinions influence the types of questions they ask and how they make sense of what they find in their research. Kuhn's argument highlights a distinction between **facts** (information about the world), and **values** (beliefs about the way the world is or ought to be). This distinction is an important one, even if it is not always clear.

To illustrate the relationship between facts and values, consider the problem of global warming. A vast accumulation of evidence (facts) substantiates the adverse impact that human activity has on the levels of greenhouse gases in Earth's atmosphere leading to changing weather patterns. There is also a set of beliefs (values), shared by many people, that influences their choices and behaviors in an attempt to address that impact (e.g., purchasing electric vehicles, recycling, bicycle commuting). Our values—in this case, that Earth as we know it is in danger and should be protected—influence how we engage with facts. People (including scientists) who strongly endorse this value, for example, might be more attentive to research on renewable energy.

The primary point of this illustration is that (contrary to the image of scientists as outside observers to the facts, gathering them neutrally and without bias from the natural world) all science—especially social sciences like psychology—involves values and interpretation. As a result, science functions best when people with diverse values and backgrounds work collectively to understand complex natural phenomena.

Indeed, science can benefit from multiple perspectives. One approach



[Untitled image by Erin I. Smith/Noba is licensed under CC BY-NC-SA 4.0.]

to achieving this is through levels of analysis. **Levels of analysis** is the idea that a single phenomenon may be explained at different levels simultaneously. Remember the question concerning cramming for a test versus studying over time? It can be answered at a number of different levels of analysis. At a low level, we might use brain scanning technologies to investigate whether biochemical processes differ between the two study strategies. At a higher level—the level of thinking—we might investigate processes of decision making (what to study) and ability to focus, as they relate to cramming versus spaced practice. At even higher levels, we might be interested in real world behaviors, such as how long people study using each of the strategies. Similarly, we might be interested in how the presence of others influences learning across these two strategies. Levels of analysis suggests that one level is not more correct—or truer—than another; their appropriateness depends on the specifics of the question asked. Ultimately, levels of analysis would suggest that we cannot understand the world around us, including human psychology, by reducing the phenomenon to only the biochemistry of genes and dynamics of neural networks. But, neither can we understand humanity without considering the functions of the human nervous system.

SCIENCE IN CONTEXT

There are many ways to interpret the world around us. People rely on common sense, personal experience, and faith, in combination and to varying degrees. All of these offer legitimate benefits to navigating one's culture, and each offers a unique perspective, with specific uses and limitations. Science provides another important way of understanding the world and, while it has many crucial advantages, as with all methods of interpretation, it also has limitations. Understanding the limits of science—including its subjectivity and uncertainty—does not render it useless. Because it is systematic, using testable, reliable data, it can allow us to determine **causality** and can help us **generalize** our conclusions. By understanding how scientific conclusions are reached, we are better equipped to use science as a tool of knowledge.

ANSWER—TEST YOURSELF 1: CAN IT BE FALSIFIED?

Answer explained: There are 4 hypotheses presented. Basically, the question asks, "Which of these could be tested and demonstrated to be false?" We can eliminate answers A, B, and C. A is a matter of personal opinion. C is a concept for which there are currently no existing measures. B is a little trickier. A person could look at data on wars, assaults, and other forms of violence to draw a conclusion about which period is the most violent. The problem here is that we do not have data for all time periods, and there is no clear guide as to which data should be used to address this hypothesis. The best answer is D, because we have the means to view other planets and to determine whether there is water on them (for example, Mars has ice).

ANSWER—TEST YOURSELF 2: INDUCTIVE OR DEDUCTIVE

Answer explained: This question asks you to consider whether each of 5 examples represents inductive or deductive reasoning. (1) Inductive: It is possible to draw the conclusion—the homeowner left in a hurry—from specific observations, such as the stove being on and the door being open. (2) Deductive: Starting with a general principle (gravity is associated with mass), we draw a conclusion about the moon having weaker gravity than does the Earth because it has smaller mass. (3) Deductive: Starting with a general principle (students do not like to pay for textbooks), it is possible to make a prediction about likely student behavior (they will not purchase textbooks). Note that this is a case of prediction rather than using observations. (4) Deductive: Starting with a general principle (students need 100 credits to graduate), it is possible to draw a conclusion about Janine (she cannot graduate because she has fewer than the 100 credits required).

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READING 6

Neurons

Sharon Furtak

SOURCE

Furtak, S. (2020). Neurons. In R. Biswas-Diener & E. Diener (Eds.), *Noba textbook series: Psychology.* DEF Publishers. http://noba.to/s678why4

LEARNING OBJECTIVES

- Differentiate the functional roles between the two main cell classes in the brain: neurons and glia.
- Describe how the forces of diffusion and electrostatic pressure work collectively to facilitate electrochemical communication.
- Define resting membrane potential, excitatory postsynaptic potentials, inhibitory postsynaptic potentials, and action potentials.
- Explain features of axonal and synaptic communication in neurons.

KEY TERMS

action potential
axon
cell membrane
dendrites
diffusion
electrostatic pressure
excitatory postsynaptic potentials (EPSPs)
inhibitory postsynaptic potentials (IPSPs)
ion channels
ionotropic receptors
myelin sheath
neurotransmitters
nucleus
resting membrane potential
soma
spines
synapse
synaptic gap
synaptic vesicles
terminal button
threshold of excitation

This module on the biological basis of behavior provides an overview of the basic structure of neurons and their means of communication. Neurons, cells in the central nervous system, receive information from our sensory systems (vision, audition, olfaction, gustation, and somatosensation) about the world around us; in turn, they plan and execute appropriate behavioral responses, including attending to a stimulus, learning new information, speaking, eating, mating, and evaluating potential threats. The goal of this module is to become familiar with the anatomical structure of neurons and to understand how neurons communicate by electrochemical signals to process sensory information and produce complex behaviors through networks of neurons. Having a basic knowledge of the fundamental structure and function of neurons is a necessary foundation as you move forward in the field of psychology.

INTRODUCTION

Imagine trying to string words together into a meaningful sentence without knowing the meaning of each word or its function (i.e., Is it a verb, a noun, or an adjective?). In a similar fashion, to appreciate how groups of cells work together in a meaningful way in the brain as a whole, we must first understand how individual cells in the brain function. Much like words, brain cells, called *neurons,* have an underlying structure that provides the foundation for their functional purpose. Have you ever seen a neuron? Did you know that the basic structure of a neuron is similar whether it is from the brain of a rat or a human? How do the billions of neurons in our brain allow us to do all the fun things we enjoy, such as texting a friend, cheering on our favorite sports team, or laughing?

Our journey in answering these questions begins more than 100 years ago with a scientist named Santiago Ramón y Cajal. Ramón y Cajal (1911) boldly concluded that discrete individual neurons are the structural and functional units of the nervous system. He based his conclusion on the numerous drawings he made of Golgi-stained tissue, a stain named after the scientist who discovered it, Camillo Golgi. Scientists use several types of stains to visualize cells. Each stain works in a unique way, which causes them to look differently when viewed under a microscope. For example, a very common Nissl stain labels only the main part of the cell (i.e., the cell body; see left and middle panels of **FIGURE 6.1**). In contrast, a Golgi stain fills the cell body and all the processes that extend outward from it (see right panel of **FIGURE 6.1**). A more notable characteristic of a Golgi stain is that it only stains approximately 1–2% of neurons (Pasternak & Woolsey, 1975; Smit & Colon, 1969), permitting the observer to distinguish one cell from another. These qualities allowed Cajal to

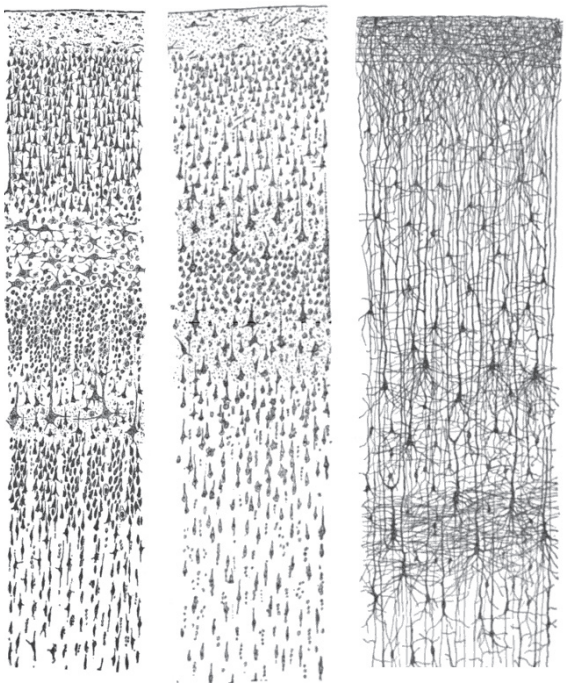

FIGURE 6.1. Three drawings by Santiago Ramón y Cajal, taken from "Comparative study of the sensory areas of the human cortex" (pp. 314, 361, and 363). Left: Nissl-stained visual cortex of a human adult. Center: Nissl-stained motor cortex of a human adult. Right: Golgi-stained cortex of a 1½-month-old infant. ["Cajal cortex drawings" by Santiago Ramón y Cajal/Wikimedia Commons is in the public domain.]

examine the full anatomical structure of individual neurons for the first time. This significantly enhanced our appreciation of the intricate networks their processes form. Based on his observation of Golgi-stained tissue, Cajal suggested neurons were distinguishable processing units rather than continuous structures. This was in opposition to the dominant theory at the time proposed by Joseph von Gerlach, which stated that the nervous system was composed of a continuous network of nerves (for review, see López-Muñoz et al., 2006). Camillo Golgi himself had been an avid supporter of Gerlach's theory. Despite their scientific disagreement, Cajal and Golgi shared the Nobel Prize for Medicine in 1906 for their combined contribution to the advancement of science and our understanding of the structure of the nervous system. This seminal work paved the pathway to our current understanding of the basic structure of the nervous system described in this module (for review, see De Carlos & Borrell, 2007; Grant, 2007).

Before moving forward, there will be an introduction to some basic terminology regarding the anatomy of neurons in the section called The Structure of the Neuron. Once we have reviewed this fundamental framework, the remainder of the module will focus on the electrochemical signals through which neurons communicate. While the electrochemical process might sound intimidating, it will be broken down into digestible sections. The first subsection, Resting Membrane Potential, describes what occurs in a neuron at rest, when it is theoretically not receiving or sending signals. Building upon this knowledge, we will examine the electrical conductance that occurs within a single neuron when it receives signals. Finally, the module will conclude with a description of the electrical conductance, which results in communication between neurons through a release of chemicals. At the end of the module, you should have a broad concept of how each cell and large groups of cells send and receive information by electrical and chemical signals.

A note of encouragement: This module introduces a vast amount of technical terminology that at times may feel overwhelming. Do not get discouraged or bogged down in the details. On your first read of this module, I suggest focusing on the broader concepts and functional aspects of the terms instead of trying to commit all the terminology to memory. That is right, I said read first! I highly suggest reading this module at least twice, once prior to *and again* following the course lecture on this material. Repetition is the best way to gain clarity and commit to memory the challenging concepts and detailed vocabulary presented here.

THE STRUCTURE OF THE NEURON

Basic Nomenclature

There are approximately 100 billion neurons in the human brain (Williams & Herrup, 1988). Each neuron has three main components: dendrites, the soma, and the axon (see **FIGURE 6.2**). **Dendrites** are processes that extend outward from the **soma**, or cell body, of a neuron and typically branch several times. Dendrites receive information from thousands of other neurons and are the main source of input of the neuron. The **nucleus**, which is located within the soma, contains genetic information, directs protein synthesis, and supplies the energy and the resources the neuron needs to function. The main source of output of the neuron is the **axon**. The axon is a process that extends far away from the soma and carries an important signal called an action potential to another neuron. The place at which the axon of one neuron comes in close contact with the dendrite of another neuron is a **synapse** (see **FIGURE 6.2** and **FIGURE 6.3**). Typically, the axon of a neuron is covered with an insulating substance called a **myelin sheath** that allows the signal and communication of one neuron to travel rapidly to another neuron.

The axon splits many times, so that it can communicate, or synapse, with several other neurons (see **FIGURE 6.2**). At the end of the axon is a **terminal button**, which forms synapses with **spines**, or protrusions, on the dendrites of neurons. Synapses form between the *presynaptic* terminal button (neuron sending the signal) and the *postsynaptic* membrane (neuron receiving the signal) (see **FIGURE 6.3**). Here we will

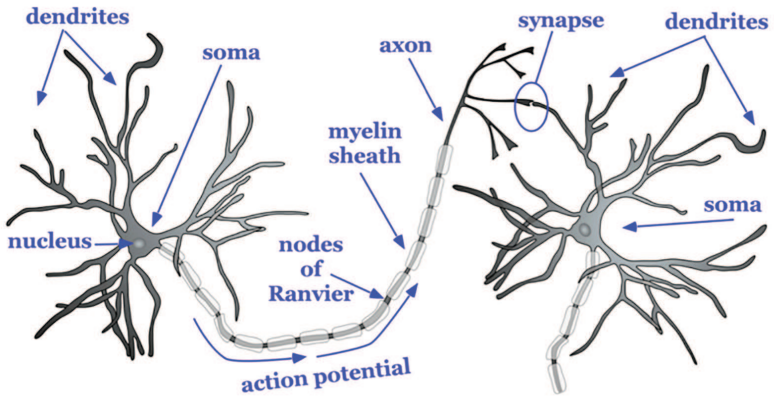

FIGURE 6.2. Basic structure of a neuron. ["Figure 2" by Sharon Furtak/Noba is licensed under CC BY-NC-SA 4.0.]

focus specifically on synapses between the terminal button of an axon and a dendritic spine; however, synapses can also form between the terminal button of an axon and the soma or the axon of another neuron.

A very small space called a **synaptic gap** or a synaptic cleft, approximately 5 nm (nanometers), exists between the presynaptic terminal button and the postsynaptic dendritic spine. To give you a better idea of the size, a dime is 1.35 mm (millimeter) thick. There are 1,350,000 nm in the thickness of a dime. In the presynaptic terminal button, there are **synaptic vesicles** that package together groups of chemicals called **neurotransmitters** (see **FIGURE 6.3**). Neurotransmitters are released from the presynaptic terminal button, travel across the synaptic gap, and activate ion channels on the postsynaptic spine by binding to *receptor sites*. We will discuss the role of receptors in more detail later in the module.

Types of Cells in the Brain

Not all neurons are created equal! There are neurons that help us receive information about the world around us, *sensory* neurons. There are *motor* neurons that allow us to initiate movement and behavior, ultimately allowing us to interact with the world around us. Finally, there are *interneurons*, which process the sensory input from our environment into meaningful representations, plan the appropriate behavioral response, and connect to the motor neurons to execute these behavioral plans.

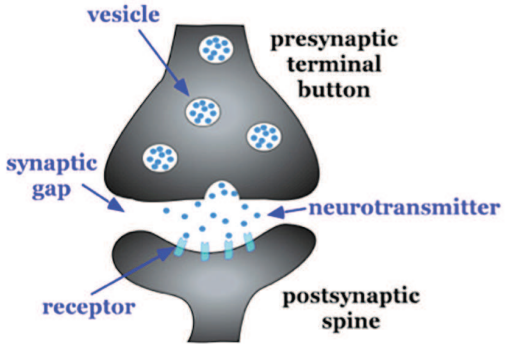

FIGURE 6.3. Characteristics of a synapse. ["Figure 3" by Sharon Furtak/Noba is licensed under CC BY-NC-SA 4.0.]

There are three main categories of neurons, each defined by its specific structure. The structures of these three different types of neurons support their unique functions. *Unipolar neurons* are structured in such a way that is ideal for relaying information forward, so they have one neurite (axon) and no dendrites. They are involved in transmission of physiological information from the body's periphery such as communicating body temperature through the spinal cord up to the brain. *Bipolar neurons* are involved in sensory perception such as perception of light in the retina of the eye. They have one axon and one dendrite which help acquire and pass sensory information to various centers in the brain. Finally, *multipolar neurons* are the most common and they communicate sensory and motor information in the brain. For example, their firing causes muscles in the body to contract. Multipolar neurons have one axon and many dendrites, which allows them to communicate with other neurons. One of the most prominent neurons is a pyramidal neuron, which falls under the multipolar category. It gets its name from the triangular or pyramidal shape of its soma (for examples see, Furtak et al., 2007).

In addition to neurons, there is a second type of cell in the brain called *glia* cells. Glia cells have several functions, just a few of which we will discuss here. One type of glia cell, called *oligodendroglia*, forms the myelin sheaths mentioned above (Simons & Trotter, 2007; see **FIGURE 6.2**). Oligodendroglia wrap their dendritic processes around the axons of neurons many times to form the myelin sheath. One cell will form the myelin sheath on several axons. Other types of glia cells, such as *microglia* and *astrocytes*, digest debris of dead neurons, carry nutritional support from blood vessels to the neurons, and help to regulate the ionic composition of the extracellular

fluid. While glial cells play a vital role in neuronal support, they do not participate in the communication between cells in the same fashion as neurons do.

COMMUNICATION WITHIN AND BETWEEN NEURONS

Thus far, we have described the main characteristics of neurons, including how their processes come in close contact with one another to form *synapses*. In this section, we consider the conduction of communication within a neuron and how this signal is transmitted to the next neuron. There are two stages of this electrochemical action in neurons. The first stage is the electrical conduction of dendritic input to the initiation of an action potential within a neuron. The second stage is a chemical transmission across the synaptic gap between the presynaptic neuron and the postsynaptic neuron of the synapse. To understand these processes, we first need to consider what occurs within a neuron when it is at a steady state, called *resting membrane potential.*

Resting Membrane Potential

The intracellular (inside the cell) fluid and extracellular (outside the cell) fluid of neurons is composed of a combination of ions (electrically charged molecules; see **FIGURE 6.4**). Cations

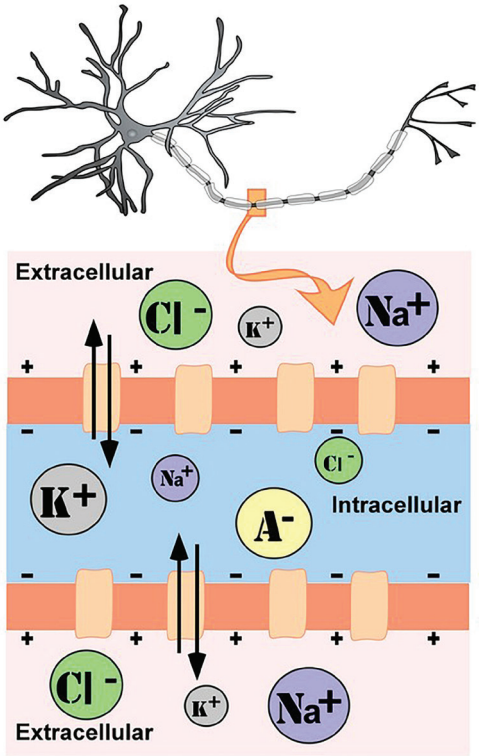

FIGURE 6.4. Representation of ion concentrations inside (intracellular) and outside (extracellular) a neuron in the unmyelinated segment of the axon. ["Figure 4" by Sharon Furtak/Noba is licensed under CC BY-NC-SA 4.0.]

are positively charged ions, and anions are negatively charged ions. The composition of intracellular and extracellular fluid is similar to salt water, containing sodium (Na^+), potassium (K^+), chloride (Cl^-), and anions (A^-).

The **cell membrane**, which is composed of a lipid bilayer of fat molecules, separates the cell from the surrounding extracellular fluid. There are proteins that span the membrane, forming **ion channels** that allow particular ions to pass between the intracellular and extracellular fluid (see **FIGURE 6.4**). These ions are in different concentrations inside the cell relative to outside the cell, and the ions have different electrical charges. Due to this difference in concentration and charge, two forces act to maintain a steady state when the cell is at rest: diffusion and electrostatic pressure. **Diffusion** is the force on molecules to move from areas of high concentration to areas of low concentration. **Electrostatic pressure** is the force on two ions with similar charge to repel each other and the force of two ions with opposite charge to attract to one another. Remember the saying, opposites attract?

Regardless of the ion, there exists a membrane potential at which the force of diffusion is equal and opposite of the force of electrostatic pressure. This voltage, called the *equilibrium potential*, is the voltage at which no ions flow. Since there are several ions that can permeate the cell's membrane, the baseline electrical charge inside the cell compared with outside the cell, referred to as **resting membrane potential**, is based on the collective drive of force on several ions. Relative to the extracellular fluid, the membrane potential of a neuron at rest is negatively charged at approximately −70 mV (see **FIGURE 6.5**). These are very small voltages compared with the voltages of batteries and electrical outlets, which we encounter daily, that range from 1.5 to 240 V.

Let us see how these two forces, diffusion and electrostatic pressure, act on the four groups of ions mentioned above.

1. *Anions (A^-):* Anions are highly concentrated inside the cell and contribute to the negative charge of the resting membrane potential. Diffusion and electrostatic pressure are not forces that determine A^- concentration because A^- is impermeable to the cell membrane. There are no ion channels that allow for A^- to move between the intracellular and extracellular fluid.
2. *Potassium (K^+):* The cell membrane is very permeable to potassium at rest, but potassium remains in high concentrations inside the cell. Diffusion pushes K^+ outside the cell because it is in high concentration inside the cell. However, electrostatic pressure pushes K^+ inside the cell because the positive charge of K^+ is attracted to the negative charge inside the cell. In combination, these forces oppose one another with respect to K^+.
3. *Chloride (Cl^-):* The cell membrane is also very permeable to chloride at rest, but chloride remains in

high concentration outside the cell. Diffusion pushes Cl^- inside the cell because it is in high concentration outside the cell. However, electrostatic pressure pushes Cl^- outside the cell because the negative charge of Cl^- is attracted to the positive charge outside the cell. Similar to K+, these forces oppose one another with respect to Cl^-.

4. *Sodium (Na^+):* The cell membrane is not very permeable to sodium at rest. Diffusion pushes Na^+ inside the cell because it is in high concentration outside the cell. Electrostatic pressure also pushes Na^+ inside the cell because the positive charge of Na^+ is attracted to the negative charge inside the cell. Both of these forces push Na^+ inside the cell; however, Na^+ cannot permeate the cell membrane and remains in high concentration outside the cell. The small amounts of Na^+ inside the cell are removed by a sodium-potassium pump, which uses the neuron's energy (adenosine triphosphate, ATP) to pump 3 Na^+ ions out of the cell in exchange for bringing 2 K^+ ions inside the cell.

Action Potential

Now that we have considered what occurs in a neuron at rest, let us consider what changes occur to the resting membrane potential when a neuron receives input, or information, from the presynaptic terminal button of another neuron. Our understanding of the electrical signals or potentials that occur within a neuron results from the seminal work of Hodgkin and Huxley that began in the 1930s at a well-known marine biology lab in Woodshole, Massachusetts. Their work, for which they won the Nobel Prize in Medicine in 1963, has resulted in the general model of electrochemical transduction that is described here (Hodgkin & Huxley, 1952). Hodgkin and Huxley studied a very large axon in the squid, a common species for that region of the United States. The giant axon of the squid is roughly 100 times larger than that of axons in the mammalian brain, making it much easier to see. Activation of the giant axon is responsible for a withdrawal response the squid uses when trying to escape from a predator, such as large fish, birds, sharks, and even humans. When was the last time you had calamari? The large axon size is no mistake in nature's design; it allows for very rapid transmission of an electrical signal, enabling a swift escape motion in the squid from its predators.

While studying this species, Hodgkin and Huxley noticed that if they applied an electrical stimulus to the axon, a large, transient electrical current conducted down the axon. This transient electrical current is known as an **action potential** (see FIGURE 6.5). An action potential is an all-or-nothing response that occurs when there is a change in the charge or potential of the cell from its resting membrane potential (−70 mV) in a more positive direction, which is a *depolarization* (see FIGURE 6.5). What is meant by an all-or-nothing response? I find that this concept is best compared to the binary code used in computers, where there are only two possibilities, 0 or 1. There is no halfway or in-between these possible values; for example, 0.5 does not exist in binary code. There are only two possibilities, either the value of 0 or the value of 1. The action potential is the same in this respect. There is no halfway; it occurs, or it does not occur. There is a specific membrane potential that the neuron must reach to initiate an action potential. This membrane potential, called the **threshold of excitation**, is typically around −50 mV. If the threshold of excitation is reached, then an action potential is triggered.

How is an action potential initiated? At any one time, each neuron is receiving hundreds of inputs from the cells that synapse with it. These inputs can cause several types of fluctuations in the neuron's membrane potentials (see FIGURE 6.5):

1. **Excitatory postsynaptic potentials (EPSPs)**: a *depolarizing* current that causes the membrane potential to become more positive and closer to the threshold of excitation; or
2. **Inhibitory postsynaptic potentials (IPSPs)**: a *hyperpolarizing* current that causes the membrane potential to become more negative and further away from the threshold of excitation.

These postsynaptic potentials, EPSPs and IPSPs, *summate* or add together in time and space. The IPSPs make the membrane potential more negative, but how much so depends on the strength of the IPSPs. The EPSPs make the membrane

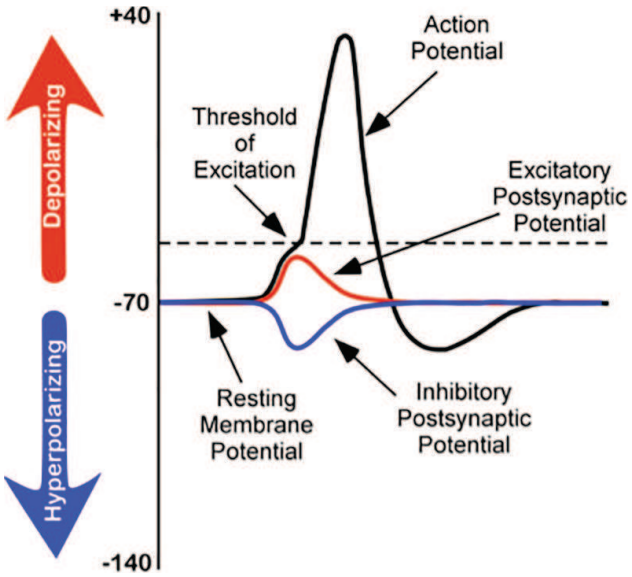

FIGURE 6.5. Changes in membrane potentials of neurons. ["Figure 5" by Sharon Furtak/Noba is licensed under CC BY-NC-SA 4.0.]

potential more positive; again, how much more positive depends on the strength of the EPSPs. If you have two small EPSPs at the same time and the same synapse then the result will be a large EPSP. If you have a small EPSP and a small IPSP at the same time and the same synapse then they will cancel each other out. Unlike the action potential, which is an all-or-nothing response, IPSPs and EPSPs are smaller and *graded* potentials, varying in strength. The change in voltage during an action potential is approximately 100 mV. In comparison, EPSPs and IPSPs are changes in voltage between 0.1 to 40 mV. They can be different strengths, or gradients, and they are measured by how far the membrane potentials diverge from the resting membrane potential.

I know the concept of summation can be confusing. As a child, I use to play a game in elementary school with a very large parachute where you would try to knock balls out of the center of the parachute. This game illustrates the properties of summation rather well. In this game, a group of children next to one another would work in unison to produce waves in the parachute in order to cause a wave large enough to knock the ball out of the parachute. The children would initiate the waves at the same time and in the same direction. The additive result was a larger wave in the parachute, and the balls would bounce out of the parachute. However, if the waves they initiated occurred in the opposite direction or with the wrong timing, the waves would cancel each other out, and the balls would remain in the center of the parachute. EPSPs or IPSPs in a neuron work in the same fashion to the properties of the waves in the parachute; they either add or cancel each other out. If you have two EPSPs, then they sum together and become a larger depolarization. Similarly, if two IPSPs come into the cell at the same time, they will sum and become a larger hyperpolarization in membrane potential. However, if two inputs were opposing one another, moving the potential in opposite directions, such as an EPSP and an IPSP, their sum would cancel each other out.

At any moment in time, each cell is receiving mixed messages, both EPSPs and IPSPs. If the summation of EPSPs is strong enough to depolarize the membrane potential to reach the threshold of excitation, then it initiates an action potential. The action potential then travels down the axon, away from the soma, until it reaches the ends of the axon (the terminal button). In the terminal button, the action potential triggers the release of neurotransmitters from the presynaptic terminal button into the synaptic gap. These neurotransmitters, in turn, cause EPSPs and IPSPs in the postsynaptic dendritic spines of the next cell (see **FIGURE 6.4** and **FIGURE 6.6**). The neurotransmitter released from the presynaptic terminal button binds with **ionotropic receptors** in a lock-and-key fashion on the post-synaptic dendritic spine. Ionotropic receptors are receptors on ion channels that open, allowing some ions to enter or exit the cell, depending upon the presence of a particular neurotransmitter. The type of neurotransmitter and the permeability of the ion channel it activates will determine if an EPSP or IPSP occurs in the dendrite of the post-synaptic cell. These EPSPs and IPSPs summate in the same fashion described above, and the entire process occurs again in another cell.

The Change in Membrane Potential During an Action Potential

We discussed previously which ions are involved in maintaining the resting membrane potential. Not surprisingly, some of these same ions are involved in the action potential. When the cell becomes depolarized (more positively charged) and reaches the threshold of excitation, this causes a voltage-dependent Na^+ channel to open. A voltage-dependent ion channel is a channel that opens, allowing some ions to enter or exit the cell, depending upon when the cell reaches a particular membrane potential. When the cell is at resting membrane potential, these voltage-dependent Na^+ channels are closed. As we learned earlier, both diffusion and electrostatic pressure are pushing Na^+ inside the cells. However, Na^+ cannot permeate the membrane when the cell is at rest. Now that these channels are open, Na^+ rushes inside the cell, causing the cell to become very positively charged relative to the outside of the cell. This is responsible for the rising or depolarizing phase of the action potential (see **FIGURE 6.5**). The inside of the cell becomes very positively charged, +40 mV. At this point, the Na^+ channels close and become *refractory.* This means the Na^+ channels cannot reopen again until after the cell returns to the resting membrane potential. Thus, a new action potential cannot occur during the refractory period. The refractory period also ensures the action potential can only move in one direction down the axon, away from the soma. As the cell becomes more depolarized, a second type of voltage-dependent channel opens; this channel is permeable to K^+. With the cell very positive relative to the outside of the cell (depolarized) and the high concentration of K^+ within the cell, both the force of diffusion and the force of electrostatic pressure drive K^+ outside of the cell. The movement of K^+ out of the cell causes the cell potential to return back to the resting membrane potential, the falling or hyperpolarizing phase of the action potential (see **FIGURE 6.5**). A short hyperpolarization occurs partially due to the gradual closing of the K^+ channels. With the Na^+ closed, electrostatic pressure continues to push K^+ out of the cell. In addition, the sodium-potassium pump is pushing Na^+ out of the cell. The cell returns to the resting membrane potential, and the excess extracellular K^+ diffuses away. This exchange of Na^+ and K^+ ions happens very rapidly, in less than 1 msec. The action potential occurs in a wave-like motion down the axon until it reaches the

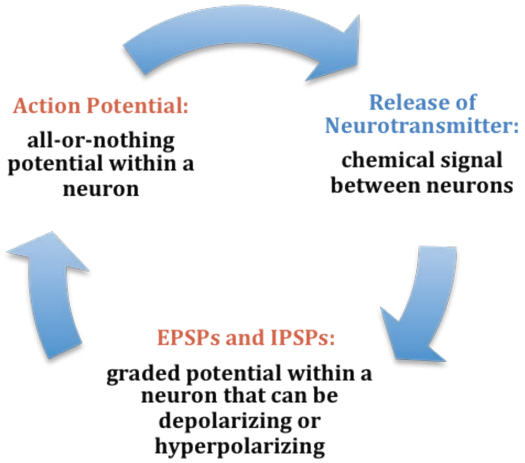

FIGURE 6.6. Summary of the electrochemical communication within and between neurons. ["Figure 6" by Sharon Furtak/Noba is licensed under CC BY-NC-SA 4.0.]

terminal button. Only the ion channels in very close proximity to the action potential are affected.

Earlier you learned that axons are covered in myelin. Let us consider how myelin speeds up the process of the action potential. There are gaps in the myelin sheaths called *nodes of Ranvier*. The myelin insulates the axon and does not allow any fluid to exist between the myelin and cell membrane. Under the myelin, when the Na^+ and K^+ channels open, no ions flow between the intracellular and extracellular fluid. This saves the cell from having to expend the energy necessary to rectify or regain the resting membrane potential. (Remember, the pumps need ATP to run.) Under the myelin, the action potential degrades some, but is still large enough in potential to trigger a new action potential at the next node of Ranvier. Thus, the action potential actively jumps from node to node; this process is known as *saltatory conduction*.

In the presynaptic terminal button, the action potential triggers the release of neurotransmitters (see **FIGURE 6.3**). Neurotransmitters cross the synaptic gap and open subtypes of receptors in a lock-and-key fashion (see **FIGURE 6.3**). Depending on the type of neurotransmitter, an EPSP or IPSP occurs in the dendrite of the postsynaptic cell. Neurotransmitters that open Na^+ or calcium (Ca^+) channels cause an EPSP; an example is the NMDA receptors, which are activated by glutamate (the main excitatory neurotransmitter in the brain). In contrast, neurotransmitters that open Cl^- or K^+ channels cause an IPSP; an example is gamma-aminobutryric acid (GABA) receptors, which are activated by GABA, the main inhibitory neurotransmitter in the brain. Once the EPSPs and IPSPs occur in the postsynaptic site, the process of communication within and between neurons cycles on (see **FIGURE 6.6**). A neurotransmitter that does not bind to receptors is broken down and inactivated by enzymes or glial cells, or it is taken back into the presynaptic terminal button in a process called *reuptake*, which will be discussed further in the module on psychopharmacology.

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READING 7

Our Brains Control Our Thoughts, Feelings, and Behavior

SOURCE

University of Minnesota. (2015). *Introduction to psychology.* University of Minnesota Libraries Publishing. https://open.lib.umn.edu/intropsyc/

LEARNING OBJECTIVES

- Describe the structures and function of the "old brain" and its influence on behavior.
- Explain the structure of the cerebral cortex (its hemispheres and lobes) and the function of each area of the cortex.
- Define the concepts of brain plasticity, neurogenesis, and brain lateralization.

KEY TERMS

amygdala
association areas
auditory cortex
brain lateralization
brain stem
cerebellum
cerebral cortex
corpus callosum
frontal lobe
glial cells (glia)
hippocampus
hypothalamus
limbic system
medulla
motor cortex
neurogenesis
neuroplasticity
occipital lobe
parietal lobe
reticular formation
somatosensory cortex
temporal lobe
thalamus
visual cortex

If you were someone who understood brain anatomy and were to look at the brain of an animal that you had never seen before, you would nevertheless be able to deduce the likely capacities of the animal. This is because the brains of all animals are very similar in overall form. In each animal the brain is layered, and the basic structures of the brain are similar (see **FIGURE 7.1**). The innermost structures of the brain—the parts nearest the spinal cord—are the oldest part of the brain, and these areas carry out the same the functions they did for our distant ancestors. The "old brain" regulates basic survival functions, such as breathing, moving, resting, and feeding, and creates our experiences of emotion. Mammals, including humans, have developed further brain layers that provide more advanced functions—for instance, better memory, more sophisticated social interactions, and the ability to experience emotions. Humans have a very large and highly developed outer layer known as the cerebral cortex (see **FIGURE 7.2**), which makes us particularly adept at these processes.

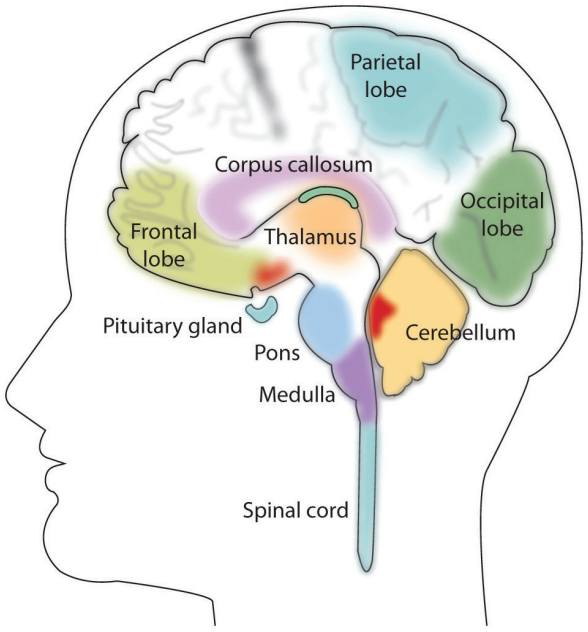

FIGURE 7.1. The major structures in the human brain. The major brain parts are colored and labeled. ["Major Structures of the Human Brain" by University of Minnesota is licensed under CC BY-NC-SA 4.0. Adapted from Camazine (n.d.).]

THE OLD BRAIN: WIRED FOR SURVIVAL

The **brain stem** is the oldest and innermost region of the brain. It's designed to control the most basic functions of life,

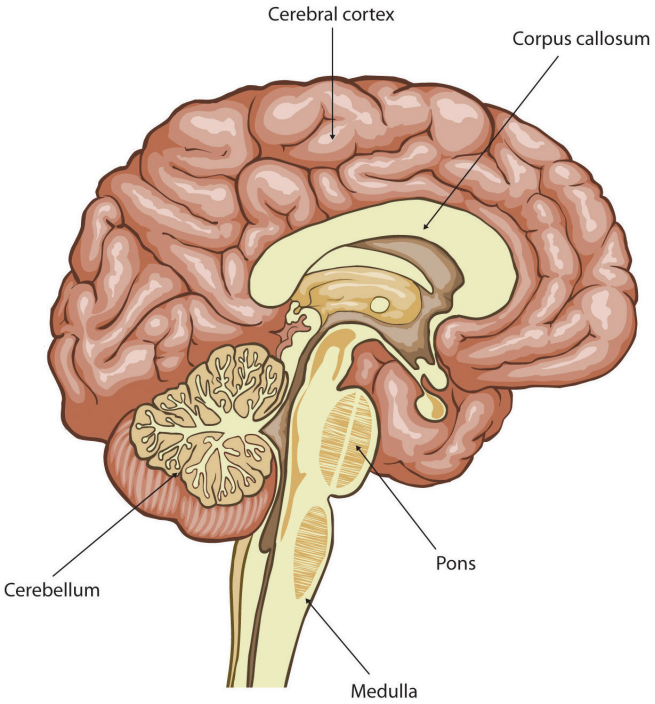

FIGURE 7.2. Cerebral cortex. Humans have a very large and highly developed outer brain layer known as the *cerebral cortex*. The cortex provides humans with excellent memory, outstanding cognitive skills, and the ability to experience complex emotions. "Cerebral Cortex" by University of Minnesota is licensed under CC BY-NC-SA 4.0. Adapted from Wikia Education (n.d.).]

including breathing, attention, and motor responses (**FIGURE 7.3**). The brain stem begins where the spinal cord enters the skull and forms the **medulla**, the area of the brain stem that controls heart rate and breathing. In many cases the medulla alone is sufficient to maintain life—animals that have the remainder of their brains above the medulla severed are still able to eat, breathe, and even move. The spherical shape above the medulla is the **pons**, a structure in the brain stem that helps control the movements of the body, playing a particularly important role in balance and walking.

Running through the medulla and the pons is a long, narrow network of neurons known as the **reticular formation**. The job of the reticular formation is to filter out some of the stimuli that are coming into the brain from the spinal cord and to relay the remainder of the signals to other areas of the brain. The reticular formation also plays important roles in walking, eating, sexual activity, and sleeping. When electrical stimulation is applied to the reticular formation of an animal, it immediately becomes fully awake, and when the reticular formation is severed from the higher brain regions, the animal falls into a deep coma.

Above the brain stem are other parts of the old brain that also are involved in the processing of behavior and emotions (see **FIGURE 7.4**). The **thalamus** is the egg-shaped structure above the brain stem that applies still more filtering to the sensory information that is coming up from the spinal cord

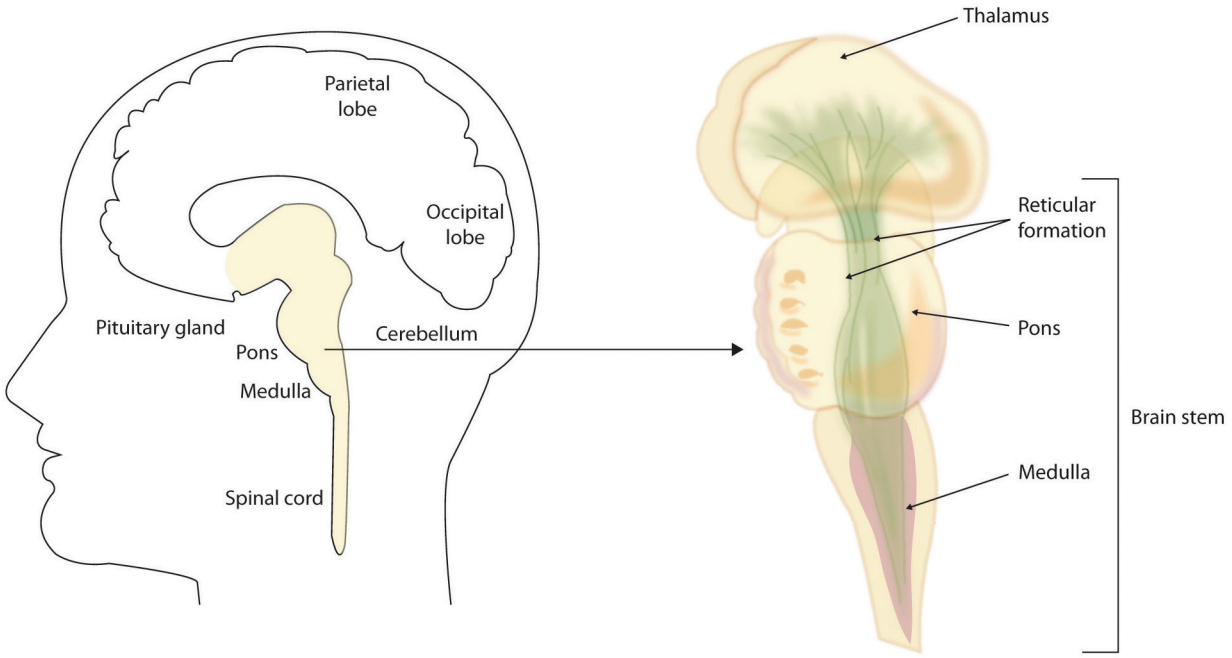

FIGURE 7.3. The brain stem and the thalamus. The brain stem is an extension of the spinal cord; it includes the medulla, the pons, the thalamus, and the reticular formation. ["Brain Stem and Thalamus" by University of Minnesota is licensed under CC BY-NC-SA 4.0.]

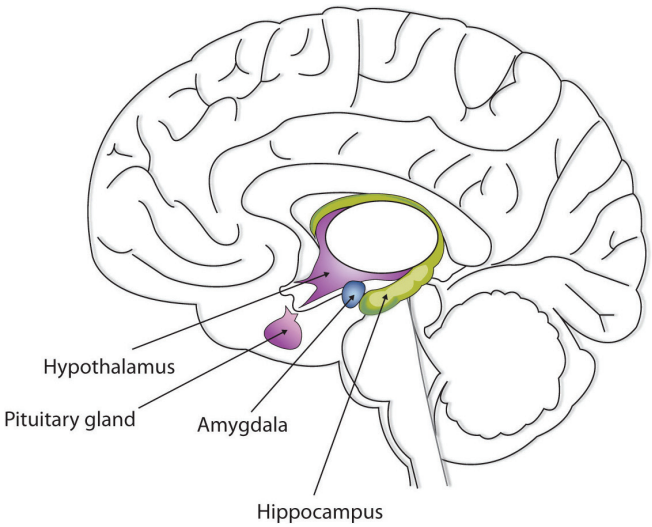

FIGURE 7.4. The limbic system. This diagram shows the major parts of the limbic system, as well as the pituitary gland, which is controlled by it. ["Limbic System" by University of Minnesota is licensed under CC BY-NC-SA 4.0.]

and through the reticular formation, and it relays some of these remaining signals to the higher brain levels (Guillery & Sherman, 2002). The thalamus also receives some of the higher brain's replies, forwarding them to the medulla and the cerebellum. The thalamus is also important in sleep because it shuts off incoming signals from the senses, allowing us to rest.

The **cerebellum** (literally, "little brain") consists of two wrinkled ovals behind the brain stem. It functions to coordinate voluntary movement. People who have damage to the cerebellum have difficulty walking, keeping their balance, and holding their hands steady. Consuming alcohol influences the cerebellum, which is why people who are drunk have more difficulty walking in a straight line. Also, the cerebellum contributes to emotional responses, helps us discriminate between different sounds and textures, and is important in learning (Bower & Parsons, 2003).

Whereas the primary function of the brain stem is to regulate the most basic aspects of life, including motor functions, the *limbic system* is largely responsible for memory and emotions, including our responses to reward and punishment. The **limbic system** is a brain area, located between the brain stem and the two cerebral hemispheres, that governs emotion and memory. It includes the amygdala, the hypothalamus, and the hippocampus.

The **amygdala** consists of two almond-shaped clusters (*amygdala* comes from the Latin word for "almond") and is primarily responsible for regulating our perceptions of, and reactions to, aggression and fear. The amygdala has connections to other bodily systems related to fear, including the sympathetic nervous system (which we will see later is important in fear responses), facial responses (which perceive and express emotions), the processing of smells, and the release of neurotransmitters related to stress and aggression (Best, 2009). In one early study, Klüver and Bucy (1939) damaged the amygdala of an aggressive rhesus monkey. They found that the once-angry animal immediately became passive and no longer responded to fearful situations with aggressive behavior. Electrical stimulation of the amygdala in other animals also influences aggression. In addition to helping us experience fear, the amygdala also helps us learn from situations that create fear. When we experience events that are dangerous, the amygdala stimulates the brain to remember the details of the situation so that we learn to avoid it in the future (Sigurdsson et al., 2007).

Located just under the thalamus (hence its name) the **hypothalamus** is a brain structure that contains a number of small areas that perform a variety of functions, including the important role of linking the nervous system to the endocrine system via the pituitary gland. Through its many interactions with other parts of the brain, the hypothalamus helps regulate body temperature, hunger, thirst, and sex, and responds to the satisfaction of these needs by creating feelings of pleasure. Olds and Milner (1954) discovered these reward centers accidentally after they had momentarily stimulated the hypothalamus of a rat. The researchers noticed that after being stimulated, the rat continued to move to the exact spot in its cage where the stimulation had occurred, as if it were trying to re-create the circumstances surrounding its original experience. Upon further research into these reward centers, Olds (1958) discovered that animals would do almost anything to re-create enjoyable stimulation, including crossing a painful electrified grid to receive it. In one experiment a rat was given the opportunity to electrically stimulate its own hypothalamus by pressing a pedal. The rat enjoyed the experience so much that it pressed the pedal more than 7,000 times per hour until it collapsed from sheer exhaustion.

The **hippocampus** consists of two "horns" that curve back from the amygdala. The hippocampus is important in storing information in long-term memory. If the hippocampus is damaged, a person cannot build new memories, living instead in a strange world where everything he or she experiences just fades away, even while older memories from the time before the damage are untouched.

THE CEREBRAL CORTEX CREATES CONSCIOUSNESS AND THINKING

All animals have adapted to their environments by developing abilities that help them survive. Some animals have hard shells, others run extremely fast, and some have acute hearing. Human beings do not have any of these particular

characteristics, but we do have one big advantage over other animals—we are very, very smart.

You might think that we should be able to determine the intelligence of an animal by looking at the ratio of the animal's brain weight to the weight of its entire body. But this does not really work. The elephant's brain is one thousandth of its weight, but the whale's brain is only one ten-thousandth of its body weight. On the other hand, although the human brain is one sixtieth of its body weight, the mouse's brain represents one fortieth of its body weight. Despite these comparisons, elephants do not seem 10 times smarter than whales, and humans definitely seem smarter than mice.

The key to the advanced intelligence of humans is not found in the size of our brains. What sets humans apart from other animals is our larger **cerebral cortex**—the outer bark-like layer of our brain that allows us to so successfully use language, acquire complex skills, create tools, and live in social groups (Gibson, 2002). In humans, the cerebral cortex is wrinkled and folded, rather than smooth as it is in most other animals. This creates a much greater surface area and size, and allows increased capacities for learning, remembering, and thinking. The folding of the cerebral cortex is referred to as *corticalization*.

Although the cortex is only about one tenth of an inch thick, it makes up more than 80% of the brain's weight. The cortex contains about 20 billion nerve cells and 300 trillion synaptic connections (de Courten-Myers, 1999). Supporting all these neurons are billions more **glial cells (glia)**, cells that surround and link to the neurons, protecting them, providing them with nutrients, and absorbing unused neurotransmitters. The glia come in different forms and have different functions. For instance, the myelin sheath surrounding the axon of many neurons is a type of glial cell. The glia are essential partners of neurons, without which the neurons could not survive or function (Miller, 2005).

The cerebral cortex is divided into two *hemispheres*, and each hemisphere is divided into four *lobes*, each separated by folds known as *fissures*. If we look at the cortex starting at the front of the brain and moving over the top (see **FIGURE 7.5**), we see first the **frontal lobe** (behind the forehead), which is responsible primarily for thinking, planning, memory, and judgment. Following the frontal lobe is the **parietal lobe**, which extends from the middle to the back of the skull and which is responsible primarily for processing information about touch. Then comes the **occipital lobe**, at the very back of the skull, which processes visual information. Finally, in front of the occipital lobe (pretty much between the ears) is the **temporal lobe**, responsible primarily for hearing and language.

FUNCTIONS OF THE CORTEX

When the German physicists Gustav Fritsch and Eduard Hitzig (1870/2009) applied mild electric stimulation to different parts of a dog's cortex, they discovered that they could make different parts of the dog's body move. Furthermore, they discovered an important and unexpected principle of brain activity. They found that stimulating the right side of the brain produced movement in the left side of the dog's body, and vice versa. This finding follows from a general principle about how the brain is structured, called *contralateral control*. The brain is wired such that in most cases the left hemisphere receives sensations from and controls the right side of the body, and vice versa.

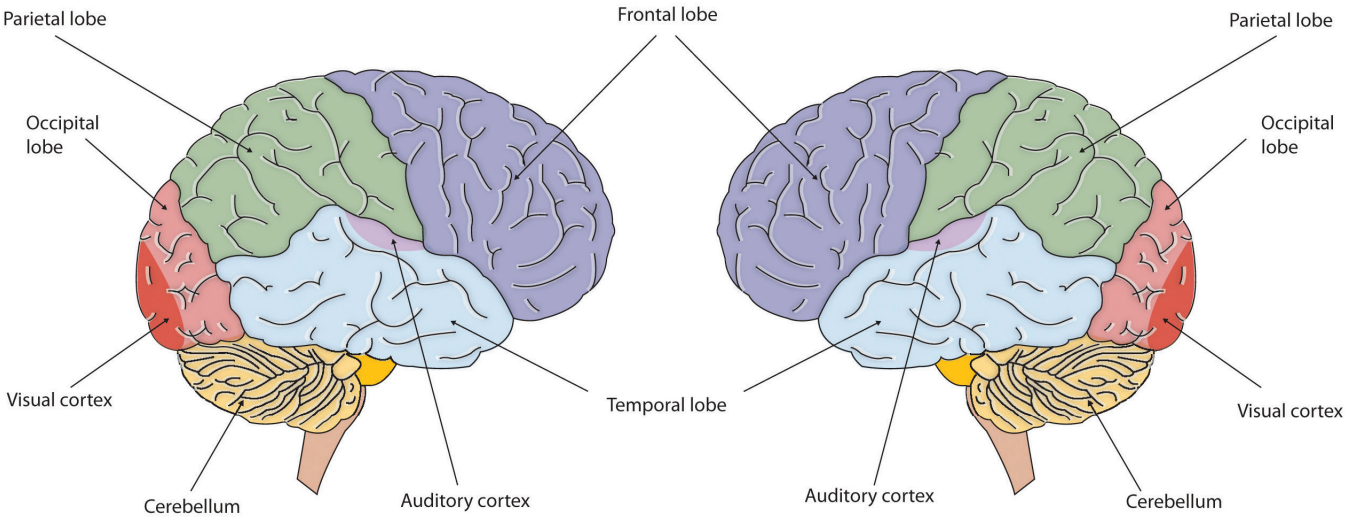

FIGURE 7.5. The two hemispheres. The brain is divided into two hemispheres (left and right), each of which has four lobes (temporal, frontal, occipital, and parietal). Furthermore, there are specific cortical areas that control different processes. ["Two Hemispheres" by University of Minnesota is licensed under CC BY-NC-SA 4.0.]

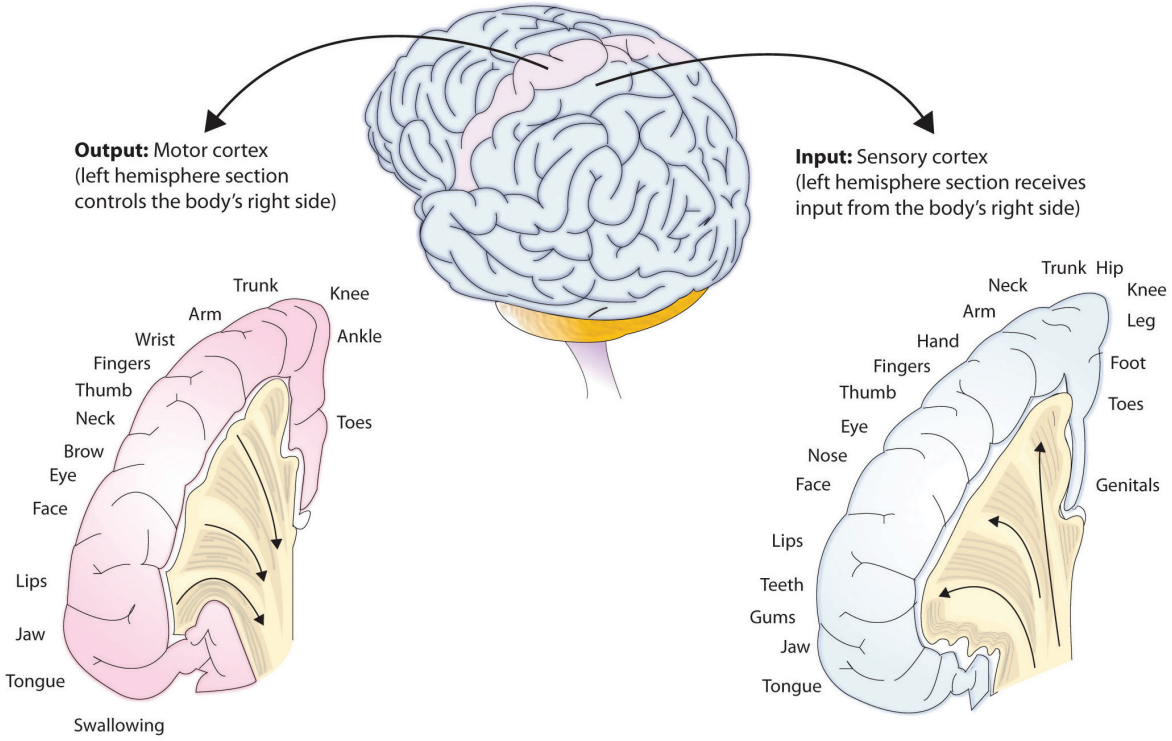

FIGURE 7.6. The sensory cortex and the motor cortex. The portion of the sensory and motor cortex devoted to receiving messages that control specific regions of the body is determined by the amount of fine movement that area is capable of performing. Thus the hand and fingers have as much area in the cerebral cortex as does the entire trunk of the body. ["Sensory Cortex and Motor Cortex" by University of Minnesota is licensed under CC BY-NC-SA 4.0.]

Fritsch and Hitzig also found that the movement that followed the brain stimulation only occurred when they stimulated a specific arch-shaped region that runs across the top of the brain from ear to ear, just at the front of the parietal lobe (see **FIGURE 7.6**). Fritsch and Hitzig had discovered the **motor cortex**, the part of the cortex that controls and executes movements of the body by sending signals to the cerebellum and the spinal cord. More recent research has mapped the motor cortex even more fully, by providing mild electronic stimulation to different areas of the motor cortex in fully conscious patients while observing their bodily responses (because the brain has no sensory receptors, these patients feel no pain). As you can see in **FIGURE 7.6**, this research has revealed that the motor cortex is specialized for providing control over the body, in the sense that the parts of the body that require more precise and finer movements, such as the face and the hands, also are allotted the greatest amount of cortical space.

Just as the motor cortex sends out messages to the specific parts of the body, the **somatosensory cortex**, an area just behind and parallel to the motor cortex at the back of the frontal lobe, receives information from the skin's sensory receptors and the movements of different body parts. Again, the more sensitive the body region, the more area is dedicated to it in the sensory cortex. Our sensitive lips, for example, occupy a large area in the sensory cortex, as do our fingers and genitals.

Other areas of the cortex process other types of sensory information. The **visual cortex** is the area located in the occipital lobe (at the very back of the brain) that processes visual information (see **FIGURE 7.5**). If you were stimulated in the visual cortex, you would see flashes of light or color, and perhaps you remember having had the experience of "seeing stars" when you were hit in, or fell on, the back of your head. The temporal lobe, located on the lower side of each hemisphere, contains the **auditory cortex**, which is responsible for hearing and language (see **FIGURE 7.5**). The temporal lobe also processes some visual information, providing us with the ability to name the objects around us (Martin, 2007).

As you can see in **FIGURE 7.6**, the motor and sensory areas of the cortex account for a relatively small part of the total cortex. The remainder of the cortex is made up of **association areas** in which sensory and motor information is combined and associated with our stored knowledge. These association areas are the places in the brain that are responsible for most of the things that make human beings seem human. The association areas are involved in higher mental functions, such as learning, thinking, planning, judging, moral reflecting, figuring, and spatial reasoning.

THE BRAIN IS FLEXIBLE: NEUROPLASTICITY

The control of some specific bodily functions, such as movement, vision, and hearing, is performed in specified areas of the cortex, and if these areas are damaged, the individual will likely lose the ability to perform the corresponding function. For instance, if an infant suffers damage to facial recognition areas in the temporal lobe, it is likely that he or she will never be able to recognize faces (Farah et al., 2000). On the other hand, the brain is not divided up in an entirely rigid way. The brain's neurons have a remarkable capacity to reorganize and extend themselves to carry out particular functions in response to the needs of the organism, and to repair damage. As a result, the brain constantly creates new neural communication routes and rewires existing ones. **Neuroplasticity** refers to the brain's ability to change its structure and function in response to experience or damage. Neuroplasticity enables us to learn and remember new things and adjust to new experiences.

Our brains are the most "plastic" when we are young children, as it is during this time that we learn the most about our environment. On the other hand, neuroplasticity continues to be observed even in adults (Kolb & Fantie, 1989). The principles of neuroplasticity help us understand how our brains develop to reflect our experiences. For instance, accomplished musicians have a larger auditory cortex compared with the general population (Bengtsson et al., 2005) and also require less neural activity to move their fingers over musical instruments than do novices (Münte et al., 2002). These observations reflect the changes in the brain that follow our experiences.

Plasticity is also observed when there is damage to the brain or to parts of the body that are represented in the motor and sensory cortexes. When a tumor in the left hemisphere of the brain impairs language, the right hemisphere will begin to compensate to help the person recover the ability to speak (Thiel et al., 2006). And if a person loses a finger, the area of the sensory cortex that previously received information from the missing finger will begin to receive input from adjacent fingers, causing the remaining digits to become more sensitive to touch (Fox, 1984).

Although neurons cannot repair or regenerate themselves as skin or blood vessels can, new evidence suggests that the brain can engage in **neurogenesis**, the forming of new neurons (Van Praag et al., 2004). These new neurons originate deep in the brain and may then migrate to other brain areas where they form new connections with other neurons (Gould, 2007). This leaves open the possibility that someday scientists might be able to "rebuild" damaged brains by creating drugs that help grow neurons.

RESEARCH FOCUS

Identifying the Unique Functions of the Left and Right Hemispheres Using Split-Brain Patients

We have seen that the left hemisphere of the brain primarily senses and controls the motor movements on the right side of the body, and vice versa. This fact provides an interesting way to study **brain lateralization**—the idea that the left and the right hemispheres of the brain are specialized to perform different functions. Gazzaniga et al. (1965) studied a patient, known as W. J., who had undergone an operation to relieve severe seizures. In this surgery the region that normally connects the two halves of the brain and supports communication between the hemispheres, known as the **corpus callosum**, is severed. As a result, the patient essentially becomes a person with two separate brains. Because the left and right hemispheres are separated, each hemisphere develops a mind of its own, with its own sensations, concepts, and motivations (Gazzaniga, 2005).

In their research, Gazzaniga and his colleagues (1965) tested the ability of W. J. to recognize and respond to objects and written passages that were presented to only the left or to only the right brain hemispheres (see **FIGURE 7.7**). The researchers had W. J. look straight ahead and then flashed, for a fraction of a second, a picture of a geometrical shape to the left of where he was looking. By doing so, they assured that—because the two hemispheres had been separated—the image of the shape was experienced only in the right brain hemisphere (remember that sensory input from the left side of the body is sent to the right side of the brain). Gazzaniga and his colleagues found that W. J. was able to identify what he had been shown when he was asked to pick the object from a series of shapes, using his left hand, but that he could not do this when the object was shown in the right visual field. On the other hand, W. J. could easily read written material presented in the right visual field (and thus experienced in the left hemisphere) but not when it was presented in the left visual field.

This research, and many other studies following it, has demonstrated that the two brain hemispheres specialize in different abilities. In most people the ability to speak, write, and understand language is located in the left hemisphere. This is why W. J. could read passages that were presented on the right side and thus transmitted to the left hemisphere, but could not read passages that were only experienced in the right brain hemisphere. The left hemisphere is also better at math and at judging time and rhythm. It is also superior in coordinating the order of complex movements—for example, lip movements needed for speech. The right

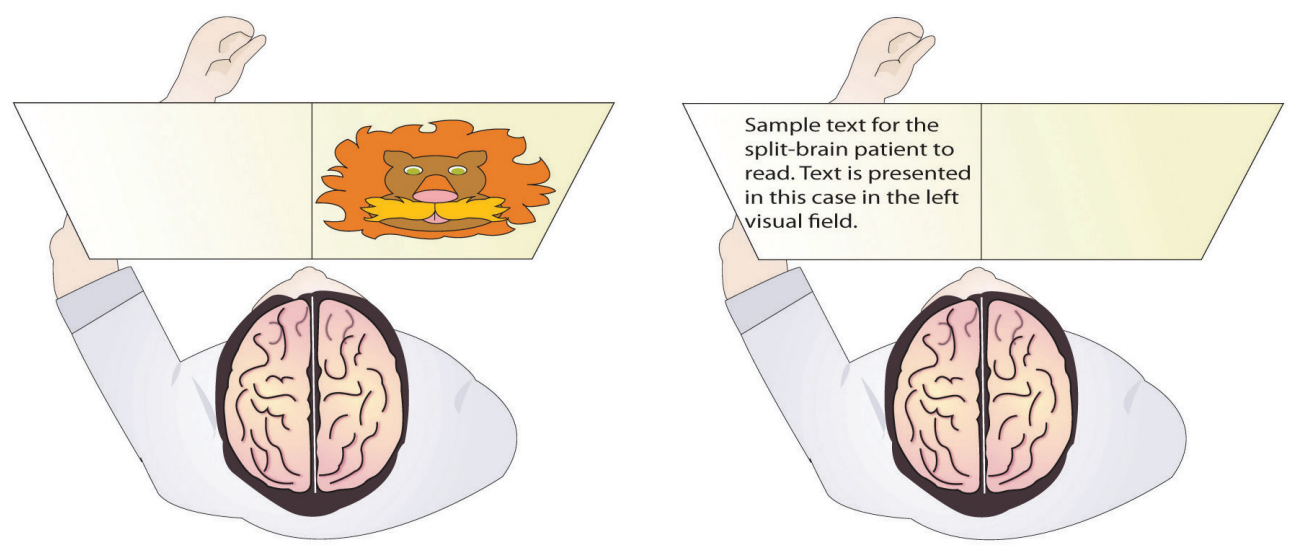

FIGURE 7.7. Visual and verbal processing in the split-brain patient. The information that is presented on the left side of our field of vision is transmitted to the right brain hemisphere, and vice versa. In split-brain patients, the severed corpus callosum does not permit information to be transferred between hemispheres, which allows researchers to learn about the functions of each hemisphere. In the sample on the left, the split-brain patient could not choose which image had been presented because the left hemisphere cannot process visual information. In the sample on the right the patient could not read the passage because the right brain hemisphere cannot process language. ["Visual and Verbal Processing in the Split-Brain Patient" by University of Minnesota is licensed under CC BY-NC-SA 4.0.]

hemisphere, on the other hand, has only very limited verbal abilities, and yet it excels in perceptual skills. The right hemisphere is able to recognize objects, including faces, patterns, and melodies, and it can put a puzzle together or draw a picture. This is why W. J. could pick out the image when he saw it on the left, but not the right, visual field.

Although Gazzaniga's research demonstrated that the brain is in fact lateralized, such that the two hemispheres specialize in different activities, this does not mean that when people behave in a certain way or perform a certain activity they are only using one hemisphere of their brains at a time. That would be drastically oversimplifying the concept of brain differences. We normally use both hemispheres at the same time, and the difference between the abilities of the two hemispheres is not absolute (Soroker et al., 2005). ■

PSYCHOLOGY IN EVERYDAY LIFE

Why Are Some People Left-Handed?

Across cultures and ethnic groups, about 90% of people are mainly right-handed, whereas only 10% are primarily left-handed (Peters et al., 2006). This fact is puzzling, in part because the number of left-handers is so low, and in part because other animals, including our closest primate relatives, do not show any type of handedness. The existence of right-handers and left-handers provides an interesting example of the relationship among evolution, biology, and social factors and how the same phenomenon can be understood at different levels of analysis (Harris, 1990; McManus, 2002).

At least some handedness is determined by genetics. Ultrasound scans show that 9 out of 10 fetuses suck the thumb of their right hand, suggesting that the preference is determined before birth (Hepper et al., 2005), and the mechanism of transmission has been linked to a gene on the X chromosome (Jones & Martin, 2000). It has also been observed that left-handed people are likely to have fewer children, and this may be in part because the mothers of left-handers are more prone to miscarriages and other prenatal problems (McKeever et al., 2000).

But culture also plays a role. In the past, left-handed children were forced to write with their right hands in many countries, and this practice continues, particularly in collectivistic

cultures, such as India and Japan, where left-handedness is viewed negatively as compared with individualistic societies, such as the United States. For example, India has about half as many left-handers as the United States (Ida & Mandal, 2003).

There are both advantages and disadvantages to being left-handed in a world where most people are right-handed. One problem for lefties is that the world is designed for right-handers. Automatic teller machines (ATMs), classroom desks, scissors, microscopes, drill presses, and table saws are just some examples of everyday machinery that is designed with the most important controls on the right side. This may explain in part why left-handers suffer somewhat more accidents than do right-handers (Dutta & Mandal, 2006).

Despite the potential difficulty living and working in a world designed for right-handers, there seem to be some advantages to being left-handed. Throughout history, a number of prominent artists have been left-handed, including Leonardo da Vinci, Michelangelo, Pablo Picasso, and Max Escher. Because the right hemisphere is superior in imaging and visual abilities, there may be some advantage to using the left hand for drawing or painting (Springer & Deutsch, 1998). Left-handed people are also better at envisioning three-dimensional objects, which may explain why there is such a high number of left-handed architects, artists, and chess players in proportion to their numbers (Coren, 1992). However, there are also more left-handers among those with reading disabilities, allergies, and migraine headaches (Geschwind & Behan, 2007), perhaps due to the fact that a small minority of left-handers owe their handedness to a birth trauma, such as being born prematurely (Betancur et al., 1990).

In sports in which handedness may matter, such as tennis, boxing, fencing, or judo, left-handers may have an advantage. They play many games against right-handers and learn how to best handle their styles. Right-handers, however, play very few games against left-handers, which may make them more vulnerable. This explains why a disproportionately high number of left-handers are found in sports where direct one-on-one action predominates. In other sports, such as golf, there are fewer left-handed players because the handedness of one player has no effect on the competition.

The fact that left-handers excel in some sports suggests the possibility that they may have also had an evolutionary advantage because their ancestors may have been more successful in important skills such as hand-to-hand combat (Bodmer & McKie, 1994). At this point, however, this idea remains only a hypothesis, and determinants of human handedness are yet to be fully understood. ■

KEY TAKEAWAYS

- The old brain—including the brain stem, medulla, pons, reticular formation, thalamus, cerebellum, amygdala, hypothalamus, and hippocampus—regulates basic survival functions, such as breathing, moving, resting, feeding, emotions, and memory.
- The cerebral cortex, made up of billions of neurons and glial cells, is divided into the right and left hemispheres and into four lobes.
- The frontal lobe is primarily responsible for thinking, planning, memory, and judgment. The parietal lobe is primarily responsible for bodily sensations and touch. The temporal lobe is primarily responsible for hearing and language. The occipital lobe is primarily responsible for vision. Other areas of the cortex act as association areas, responsible for integrating information.
- The brain changes as a function of experience and potential damage in a process known as plasticity. The brain can generate new neurons through neurogenesis.
- The motor cortex controls voluntary movements. Body parts requiring the most control and dexterity take up the most space in the motor cortex.
- The sensory cortex receives and processes bodily sensations. Body parts that are the most sensitive occupy the greatest amount of space in the sensory cortex.
- The left cerebral hemisphere is primarily responsible for language and speech in most people, whereas the right hemisphere specializes in spatial and perceptual skills, visualization, and the recognition of patterns, faces, and melodies.
- The severing of the corpus callosum, which connects the two hemispheres, creates a "split-brain patient," with the effect of creating two separate minds operating in one person.
- Studies with split-brain patients as research participants have been used to study brain lateralization.
- Neuroplasticity allows the brain to adapt and change as a function of experience or damage.

EXERCISES AND CRITICAL THINKING

1. Do you think that animals experience emotion? What aspects of brain structure might lead you to believe that they do or do not?
2. Consider your own experiences and speculate on which parts of your brain might be particularly well developed as a result of these experiences.

3. Which brain hemisphere are you likely to be using when you search for a fork in the silverware drawer? Which brain hemisphere are you most likely to be using when you struggle to remember the name of an old friend?
4. Do you think that encouraging left-handed children to use their right hands is a good idea? Why or why not?

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READING 8

Psychophysiological Methods in Neuroscience

Zachary Infantolino and Gregory A. Miller

SOURCE

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LEARNING OBJECTIVES

- Learn what qualifies as psychophysiology within the broader field of neuroscience.
- Review and compare several examples of psychophysiological methods.
- Understand advantages and disadvantages of different psychophysiological methods.

KEY TERMS

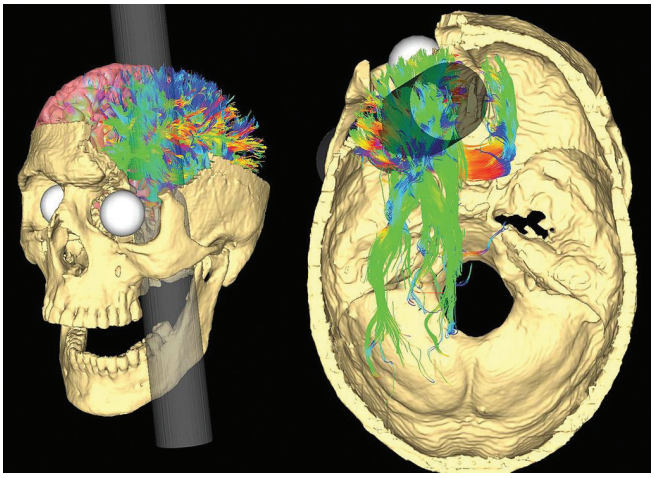
blood-oxygen-level-dependent (BOLD)
deoxygenated hemoglobin
depolarization
hemoglobin
hyperpolarization
invasive
lesions
neural plasticity
neuroscience methods
noninvasive
oxygenated hemoglobin
parasympathetic nervous system (PNS)
peripheral nervous system
positron
psychophysiological methods
spatial resolution
sympathetic nervous system (SNS)
temporal resolution
voltage

As a generally noninvasive subset of neuroscience methods, psychophysiological methods are used across a variety of disciplines in order to answer diverse questions about psychology, both mental events and behavior. Many different techniques are classified as psychophysiological. Each technique has its strengths and weaknesses, and knowing them allows researchers to decide what each offers for a particular question. Additionally, this knowledge allows research consumers to evaluate the meaning of the results in a particular experiment.

HISTORY

In the mid-nineteenth century, a railroad worker named Phineas Gage was in charge of setting explosive charges for blasting through rock in order to prepare a path for railroad tracks. He would lay the charge in a hole drilled into the rock, place a fuse and sand on top of the charge, and pack it all down using a tamping iron (a solid iron rod approximately one yard long and a little over an inch in diameter). On a September afternoon when Gage was performing this task, his tamping iron caused a spark that set off the explosive prematurely, sending the tamping iron flying through the air.

Unfortunately for Gage, his head was above the hole and the tamping iron entered the side of his face, passed behind his left eye, and exited out of the top of his head, eventually landing 80 feet away. Gage lost a portion of his left frontal lobe in the accident, but survived and lived for another 12 years. What is most interesting from a psychological perspective is that Gage's personality changed as a result of this accident. He became more impulsive, he had trouble carrying out plans,



Renderings of Phineas Gage's skull. Unlike other areas of the body, damage to the brain isn't localized to that specific region; injuries have widespread consequences for other areas, too. ["Simulated Connectivity Damage of Phineas Gage 4 vanHorn PathwaysDamaged" by J. D. Van Horn, A. Irimia, C. M. Torgerson, M. C. Chambers, R. Kikinis R, and A. W. Toga (2012) is licensed under CC BY 2.5.]

and, at times, he engaged in vulgar profanity, which was out of character. This case study leads one to believe that there are specific areas of the brain that are associated with certain psychological phenomena. When studying psychology, the brain is indeed an interesting source of information. Although it would be impossible to replicate the type of damage done to Gage in the name of research, methods have developed over the years that are able to safely measure different aspects of nervous system activity in order to help researchers better understand psychology as well as the relationship between psychology and biology.

INTRODUCTION

Psychophysiology is defined as any research in which the dependent variable (what the researcher measures) is a physiological measure, and the independent variable (what the researcher manipulates) is behavioral or mental. In most cases the work is done noninvasively with awake human participants. Physiological measures take many forms and range from blood flow or neural activity in the brain to heart rate variability and eye movements. These measures can provide information about processes including emotion, cognition, and the interactions between them. In these ways, physiological measures offer a very flexible set of tools for researchers to answer questions about behavior, cognition, and health.

Psychophysiological methods are a subset of the very large domain of **neuroscience methods**. Many neuroscience methods are **invasive**, such as involving **lesions** of neural tissue, injection of neutrally active chemicals, or manipulation of neural activity via electrical stimulation. The present survey emphasizes **noninvasive** methods widely used with human subjects.

Crucially, in examining the relationship between physiology and overt behavior or mental events, psychophysiology does not attempt to replace the latter with the former. As an example, happiness is a state of pleasurable contentment and is associated with various physiological measures, but one would not say that those physiological measures *are* happiness. We can make inferences about someone's cognitive or emotional state based on his or her self-report, physiology, or overt behavior. Sometimes our interest is primarily in inferences about internal events and sometimes primarily in the physiology itself. Psychophysiology addresses both kinds of goals.

CENTRAL NERVOUS SYSTEM (CNS)

This module provides an overview of several popular psychophysiological methods, though it is far from exhaustive. Each method can draw from a broad range of data-analysis strategies to provide an even more expansive set of tools. The psychophysiological methods discussed below focus on the central nervous system. Structural magnetic resonance

The adult human brain only makes up about 2% (i.e., ≈ 3 pounds) of the average adult's weight, but it uses 20% of the body's energy! ["Human brain on white background" by _DJ_/Flickr is licensed under CC BY-SA 2.0.]

imaging (sMRI) is a noninvasive technique that allows researchers and clinicians to view anatomical structures within a human. The participant is placed in a magnetic field that may be 66,000 times greater than the Earth's magnetic field, which causes a small portion of the atoms in his or her body to line up in the same direction. The body is then pulsed with low-energy radio frequencies that are absorbed by the atoms in the body, causing them to tip over. As these atoms return to their aligned state, they give off energy in the form of harmless electromagnetic radiation, which is measured by the machine. The machine then transforms the measured energy into a three-dimensional picture of the tissue within the body. In psychophysiology research, this image may be used to compare the size of structures in different groups of people (e.g., are areas associated with pleasure smaller in individuals with depression?) or to increase the accuracy of spatial locations as measured with functional magnetic resonance imaging.

Functional magnetic resonance imaging (fMRI) is a method that is used to assess changes in activity of tissue, such as measuring changes in neural activity in different areas of the brain during thought. This technique builds on the principles of sMRI and also uses the property that, when neurons fire, they use energy, which must be replenished. Glucose and oxygen, two key components for energy production, are supplied to the brain from the blood stream as needed. Oxygen is transported through the blood using **hemoglobin**, which contains binding sites for oxygen. When these sites are saturated with oxygen, it is referred to as **oxygenated hemoglobin**. When the oxygen molecules have all been released from a hemoglobin molecule, it is known as **deoxygenated hemoglobin**. As a set of neurons begins firing, oxygen in the blood surrounding those neurons is consumed, leading to a reduction in oxygenated hemoglobin. The body

then compensates and provides an abundance of oxygenated hemoglobin in the blood surrounding that activated neural tissue. When activity in that neural tissue declines, the level of oxygenated hemoglobin slowly returns to its original level, which typically takes several seconds.

fMRI measures the change in the concentration of oxygenated hemoglobin, which is known as the **blood-oxygen-level-dependent (BOLD)** signal. This leads to two important facts about fMRI. First, fMRI measures blood volume and blood flow, and from this we infer neural activity; fMRI does not measure neural activity directly. Second, fMRI data typically have poor **temporal resolution** (the precision of measurement with respect to time); however, when combined with sMRI, fMRI provides excellent **spatial resolution** (the ability to distinguish one object from another in space). Temporal resolution for fMRI is typically on the order of seconds, whereas its spatial resolution is on the order of millimeters. Under most conditions there is an inverse relationship between temporal and spatial resolution—one can increase temporal resolution at the expense of spatial resolution and vice versa.

This method is valuable for identifying specific areas of the brain that are associated with different physical or psychological tasks. Clinically, fMRI may be used before neurosurgery in order to identify areas that are associated with language so that the surgeon can avoid those areas during the operation. fMRI allows researchers to identify differential or convergent patterns of activation associated with tasks. For example, if participants are shown words on a screen and are expected to indicate the color of the letters, are the same brain areas recruited for this task if the words have emotional content or not? Does this relationship change in psychological disorders such as anxiety or depression? Is there a different pattern of activation even in the absence of overt performance differences? fMRI is an excellent tool for comparing brain activation in different tasks and/or populations. **FIGURE 8.1** provides an example of results from fMRI analyses overlaid on an sMRI image. The blue and orange shapes represent areas with significant changes in the BOLD signal, thus changes in neural activation.

Electroencephalography (EEG) is another technique for studying brain activation. This technique uses at least two and sometimes up to 256 electrodes to measure the difference in electrical charge (the **voltage**) between pairs of points on the head. These electrodes are typically fastened to a flexible cap (similar to a swimming cap) that is placed on the participant's head. From the scalp, the electrodes measure the electrical activity that is naturally occurring within the brain. They do not introduce any new electrical activity. In contrast to fMRI, EEG measures neural activity directly, rather than a correlate of that activity.

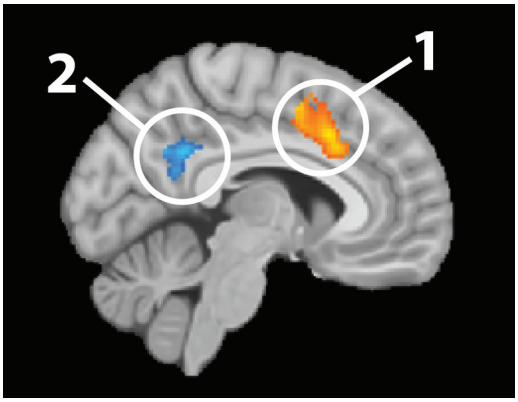


FIGURE 8.1. Example of fMRI analyses overlaid on an sMRI image. Area 1 (orange) indicates an increase in the BOLD signal, and Area 2 (blue) indicates a decrease in the BOLD signal. We infer that neural activity increased in the Area 1 and decreased in Area 2. ["Figure 1" by Zachary Infantolino and Gregory A. Miller/Noba is licensed under CC BY-NC-SA 4.0.]

Electrodes used in EEG can also be placed within the skull, resting directly on the brain itself. This application, called electrocorticography (ECoG), is typically used before medical procedures for localizing activity, such as the origin of epileptic seizures. This invasive procedure allows for more precise localization of neural activity, which is essential in medical applications. However, it is generally not justifiable to open a person's skull solely for research purposes, and instead electrodes are placed on the participant's scalp, resulting in a noninvasive technique for measuring neural activity.

Given that this electrical activity must travel through the skull and scalp before reaching the electrodes, localization of activity is less precise when measuring from the scalp, but it can still be within several millimeters when localizing activity that is near the scalp. One major advantage of EEG is its temporal resolution. Data can be recorded thousands of times per second, allowing researchers to document events that happen in less than a millisecond. EEG analyses typically investigate the change in amplitude or frequency components of the recorded EEG on an ongoing basis or averaged over dozens of trials (see **FIGURE 8.2**).

Magnetoencephalography (MEG) is another technique for noninvasively measuring neural activity. The flow of electrical charge (the current) associated with neural activity produces very weak magnetic fields that can be detected by sensors placed near the participant's scalp. The number of sensors used varies from a few to several hundred. Due to the fact that the magnetic fields of interest are so small, special rooms that are shielded from magnetic fields in the environment are needed in order to avoid contamination of the signal being measured. MEG has the same excellent temporal resolution as EEG. Additionally, MEG is not as susceptible to distortions from the skull and scalp. Magnetic fields are able

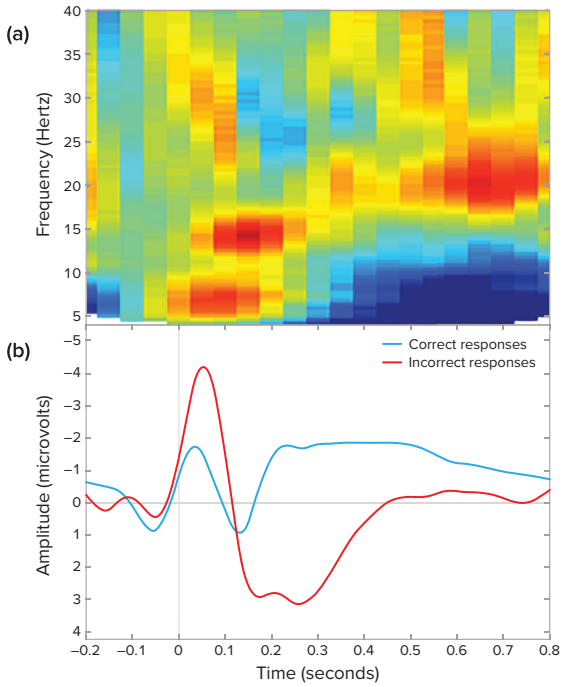


FIGURE 8.2. Example of EEG analysis output. Panel (a) represents changes in the relative strength of different frequencies in the EEG data over time. Panel (b) represents changes in the amplitude in the instantaneous EEG voltage over time. [This work, "EEG Analysis Output," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Figure 2" by Zachary Infantolino and Gregory A. Miller/ Noba, which is licensed under CC BY-NC-SA 4.0.]

to pass through the hard and soft tissue relatively unchanged, thus providing better spatial resolution than EEG. MEG analytic strategies are nearly identical to those used in EEG. However, the MEG recording apparatus is much more expensive than EEG, so MEG is much less widely available.

EEG and MEG are both excellent for elucidating the temporal dynamics of neural processes. For example, if someone is reading a sentence that ends with an unexpected word (e.g., Michelle is going outside to water the book), how long after he or she reads the unexpected word does he or she recognize this as unexpected? In addition to these types of questions, EEG and MEG methods allow researchers to investigate the degree to which different parts of the brain "talk" to each other. This allows for a better understanding of brain networks, such as their role in different tasks and how they may function abnormally in psychopathology.

Positron emission tomography (PET) is a medical imaging technique that is used to measure processes in the body, including the brain. This method relies on a positron-emitting tracer atom that is introduced into the blood stream in a biologically active molecule, such as glucose, water, or ammonia. A **positron** is a particle much like an electron but with a positive charge. One example of a biologically active molecule is fludeoxyglucose, which acts similarly to glucose in the body. Fludeoxyglucose will concentrate in areas where glucose is needed—commonly areas with higher metabolic needs. Over time, this tracer molecule emits positrons, which are detected by a sensor. The spatial location of the tracer molecule in the brain can be determined based on the emitted positrons. This allows researchers to construct a three-dimensional image of the areas of the brain that have the highest metabolic needs, typically those that are most active. Images resulting from PET usually represent neural activity that has occurred over tens of minutes, which is very poor temporal resolution for some purposes. PET images are often combined with computed tomography (CT) images to improve spatial resolution, as fine as several millimeters. Tracers can also be incorporated into molecules that bind to neurotransmitter receptors, which allows researchers to answer some unique questions about the action of neurotransmitters. Unfortunately, very few research centers have the equipment required to obtain the images or the special equipment needed to create the positron-emitting tracer molecules, which typically need to be produced on site.

Transcranial magnetic stimulation (TMS) is a noninvasive method that causes **depolarization** or **hyperpolarization** in neurons near the scalp. This method is not considered psychophysiological because the independent variable is physiological, rather than the dependent. However, it does qualify as a neuroscience method because it deals with the function of the nervous system, and it can readily be combined with conventional psychophysiological methods. In TMS, a coil of wire is placed just above the participant's scalp. When electricity flows through the coil, it produces a magnetic field. This magnetic field travels through the skull and scalp and affects neurons near the surface of the brain. When the magnetic field is rapidly turned on and off, a current is induced in the neurons, leading to depolarization or hyperpolarization, depending on the number of magnetic field pulses. Single- or paired-pulse TMS depolarizes site-specific neurons in the cortex, causing them to fire. If this method is used over primary motor cortex, it can produce or block muscle activity, such as inducing a finger twitch or preventing someone from pressing a button. If used over primary visual cortex, it can produce sensations of flashes of light or impair visual processes. This has proved to be a valuable tool in studying the function and timing of specific processes such as the recognition of visual stimuli. Repetitive TMS produces effects that last longer than the initial stimulation. Depending on the intensity, coil orientation, and frequency, neural activity in the stimulated area may be either attenuated or amplified. Used in this manner, TMS is able to explore **neural plasticity**, which is the ability of connections between neurons to change. This has implications for treating psychological disorders as well as understanding long-term changes in neuronal excitability.

PERIPHERAL NERVOUS SYSTEM

The psychophysiological methods discussed above focus on the central nervous system. Considerable research has also focused on the **peripheral nervous system**. These methods include skin conductance, cardiovascular responses, muscle activity, pupil diameter, eye blinks, and eye movements. Skin conductance, for example, measures the electrical conductance (the inverse of resistance) between two points on the skin, which varies with the level of moisture. Sweat glands are responsible for this moisture and are controlled by the **sympathetic nervous system (SNS)**. Increases in skin conductance can be associated with changes in psychological activity. For example, studying skin conductance allows a researcher to investigate whether psychopaths react to fearful pictures in a normal way. Skin conductance provides relatively poor temporal resolution, with the entire response typically taking several seconds to emerge and resolve. However, it is an easy way to measure SNS response to a variety of stimuli.

Cardiovascular measures include heart rate, heart rate variability, and blood pressure. The heart is innervated by the **parasympathetic nervous system (PNS)** and SNS. Input from the PNS decreases heart rate and contractile strength, whereas input from the SNS increases heart rate and contractile strength. Heart rate can easily be monitored using a minimum of two electrodes and is measured by counting the number of heartbeats in a given time period, such as one minute, or by assessing the time between successive heartbeats. Psychological activity can prompt increases and decreases in heart rate, often in less than a second, making heart rate a sensitive measure of cognition. Measures of heart rate variability are concerned with consistency in the time interval between heartbeats. Changes in heart rate variability are associated with stress as well as psychiatric conditions. **FIGURE 8.3** is an example of an electrocardiogram, which is used to measure heart rate and heart rate variability. These cardiovascular measures allow researchers to monitor SNS and PNS reactivity to various stimuli or situations. For example, when an arachnophobe views pictures of spiders, does their heart rate increase more than that of a person not afraid of spiders?

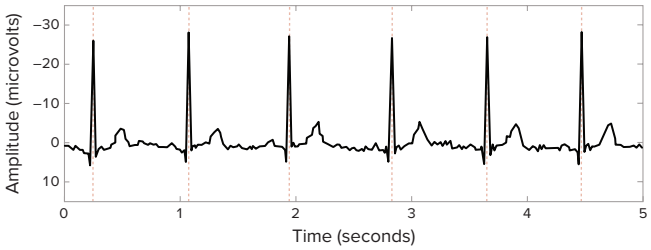


FIGURE 8.3. Example of electrocardiogram. The number of strong negative spikes in the output during a given period of time represents the heart rate, whereas the difference in the spacing between those strong negative spikes represents the heart rate variability. [This work, "ECG Output," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Figure 3" by Zachary Infantolino and Gregory A. Miller/Noba, which is licensed under CC BY-NC-SA 4.0.]

Electromyography (EMG) measures electrical activity produced by skeletal muscles. Similar to EEG, EMG measures the voltage between two points. This technique can be used to determine when a participant first initiates muscle activity to engage in a motor response to a stimulus or the degree to which a participant begins to engage in an incorrect response (such as pressing the wrong button), even if it is never visibly executed. It has also been used in emotion research to identify activity in muscles that are used to produce smiles and frowns. Using EMG, it is possible to detect very small facial movements that are not observable from looking at the face. The temporal resolution of EMG is similar to that of EEG and MEG.

Valuable information can also be gleaned from eye blinks, eye movements, and pupil diameter. Eye blinks are most often assessed using EMG electrodes placed just below the eyelid, but electrical activity associated directly with eye blinks or eye movements can be measured with electrodes placed on the face near the eyes, because there is voltage across the entire eyeball. Another option for the measurement of eye movement is a camera used to record video of an eye. This video method is particularly valuable when determination of absolute direction of gaze (not just change in direction of gaze) is of interest, such as when the eyes scan a picture. With the help of a calibration period in which a participant looks at multiple, known targets, eye position is then extracted from each video frame during the main task and compared with data from the calibration phase, allowing researchers to identify the sequence, direction, and duration of gaze fixations. For example, when viewing pleasant or unpleasant images, people spend different amounts of time looking at the most arousing parts. This, in turn, can vary as a function of psychopathology. Additionally, the diameter of a participant's pupil can be measured and recorded over time from the video record. As with heart rate, pupil diameter is controlled by competing inputs from the SNS and PNS. Pupil diameter is commonly used as an index of mental effort when performing a task.

WHEN TO USE WHAT

As the reader, you may be wondering, how do I know what tool is right for a given question? Generally, there are no definitive answers. If you wanted to know the temperature in the morning, would you check your phone? Look outside to see how warm it looks? Ask your roommate what he or she is wearing today? Look to see what other people are wearing? There is not a single way to answer the question. The same is true for research questions. However, there are some guidelines that one can consider. For example, if you are interested in what brain structures are associated with cognitive control,

you wouldn't use peripheral nervous system measures. A technique such as fMRI or PET might be more appropriate. If you are interested in how cognitive control unfolds over time, EEG or MEG would be a good choice. If you are interested in studying the bodily response to fear in different groups of people, peripheral nervous system measures might be most appropriate. The key to deciding what method is most appropriate is properly defining the question that you are trying to answer. What aspects are most interesting? Do you care about identifying the most relevant brain structures? Temporal dynamics? Bodily responses? Then, it is important to think about the strengths and weaknesses of the different psychophysiological measures and pick one, or several, whose attributes work best for the question at hand. In fact, it is common to record several at once.

CONCLUSION

The outline of psychophysiological methods above provides a glimpse into the exciting techniques that are available to researchers studying a broad range of topics from clinical to social to cognitive psychology. Some of the most interesting psychophysiological studies use several methods, such as in sleep assessments or multimodal neuroimaging. Psychophysiological methods have applications outside of mainstream psychology in areas where psychological phenomena are central, such as economics, health-related decision making, and brain–computer interfaces. Examples of applications for each method are provided above, but this list is by no means exhaustive. Furthermore, the field is continually evolving, with new methods and new applications being developed. The wide variety of methods and applications provide virtually limitless possibilities for researchers.

REFERENCE

Van Horn, J. D., Irimia, A., Torgerson, C. M., Chambers, M. C., Kikinis, R., & Toga, A. W. (2012). Mapping connectivity damage in the case of Phineas Gage. *PloS One, 7*(5), e37454. https://doi.org/10.1371/journal.pone.0037454

READING 9

What Is Consciousness?

SOURCE

OpenStax. (2019). *Psychology.* OpenStax CNX. https://openstax.org/details/books/psychology

LEARNING OBJECTIVES

- Understand what is meant by consciousness.
- Explain how circadian rhythms are involved in regulating the sleep-wake cycle, and how circadian cycles can be disrupted.
- Discuss the concept of sleep debt.

KEY TERMS

biological rhythms
circadian rhythm
consciousness
homeostasis
insomnia
jet lag
melatonin
meta-analysis
pineal gland
rotating shift work
sleep
sleep debt
sleep regulation
suprachiasmatic nucleus (SCN)
wakefulness

Consciousness describes our awareness of internal and external stimuli. Awareness of internal stimuli includes feeling pain, hunger, thirst, sleepiness, and being aware of our thoughts and emotions. Awareness of external stimuli includes seeing the light from the sun, feeling the warmth of a room, and hearing the voice of a friend.

We experience different states of consciousness and different levels of awareness on a regular basis. We might even describe consciousness as a continuum that ranges from full awareness to a deep sleep. **Sleep** is a state marked by relatively low levels of physical activity and reduced sensory awareness that is distinct from periods of rest that occur during wakefulness. **Wakefulness** is characterized by high levels of sensory awareness, thought, and behavior. Between these extremes are states of consciousness related to daydreaming, intoxication as a result of alcohol or other drug use, meditative states, hypnotic states, and altered states of consciousness following sleep deprivation. We might also experience unconscious states of being via drug-induced anesthesia for medical purposes. Often, we are not completely aware of our surroundings, even when we are fully awake. For instance, have you ever daydreamed while driving home from work or school without really thinking about the drive itself? You were capable of engaging in the all of the complex tasks involved with operating a motor vehicle even though you were not aware of doing so. Many of these processes, like much of psychological behavior, are rooted in our biology.

BIOLOGICAL RHYTHMS

Biological rhythms are internal rhythms of biological activity. A woman's menstrual cycle is an example of a biological rhythm—a recurring, cyclical pattern of bodily changes. One complete menstrual cycle takes about 28 days—a lunar month—but many biological cycles are much shorter. For example, body temperature fluctuates cyclically over a 24-hour period (FIGURE 9.1). Alertness is associated with higher body temperatures, and sleepiness with lower body temperatures.

This pattern of temperature fluctuation, which repeats every day, is one example of a circadian rhythm. A **circadian rhythm** is a biological rhythm that takes place over a period of about 24 hours. Our sleep-wake cycle, which is linked to

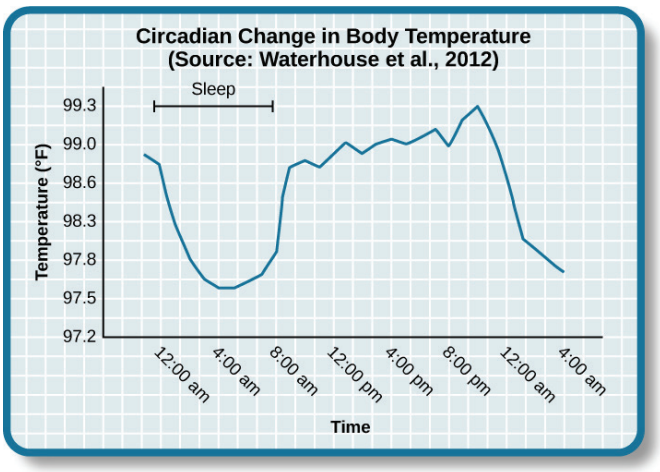


FIGURE 9.1. The circadian change in body temperature over 28 hours in a group of eight young men. Body temperature rises throughout the waking day, peaking in the afternoon, and falls during sleep with the lowest point occurring during the very early morning hours. ["Figure 4.2"/OpenStax is licensed under CC BY 4.0. Data from Waterhouse et al. (2012).]

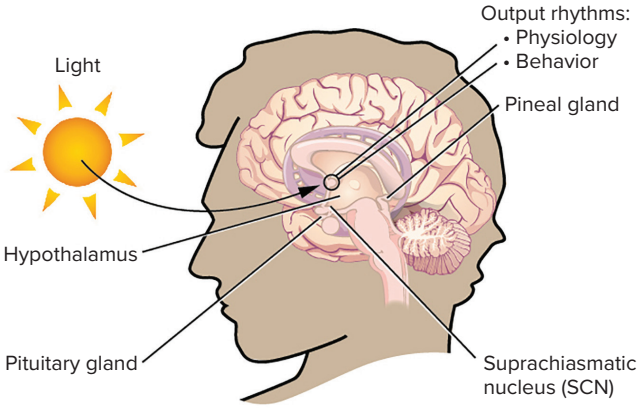


FIGURE 9.2. The suprachiasmatic nucleus (SCN) serves as the brain's clock mechanism. The clock sets itself with light information received through projections from the retina. [This work, "Suprachiasmatic Nucleus," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Figure 4.3"/OpenStax, which is licensed under CC BY 4.0.]

our environment's natural light-dark cycle, is perhaps the most obvious example of a circadian rhythm, but we also have daily fluctuations in heart rate, blood pressure, blood sugar, and body temperature. Some circadian rhythms play a role in changes in our state of consciousness.

If we have biological rhythms, then is there some sort of biological clock? In the brain, the hypothalamus, which lies above the pituitary gland, is a main center of homeostasis. **Homeostasis** is the tendency to maintain a balance, or optimal level, within a biological system.

The brain's clock mechanism is located in an area of the hypothalamus known as the **suprachiasmatic nucleus (SCN)**. The axons of light-sensitive neurons in the retina provide information to the SCN based on the amount of light present, allowing this internal clock to be synchronized with the outside world (Klein et al., 1991; Welsh et al., 2010) (**FIGURE 9.2**).

PROBLEMS WITH CIRCADIAN RHYTHMS

Generally, and for most people, our circadian cycles are aligned with the outside world. For example, most people sleep during the night and are awake during the day. One important regulator of sleep-wake cycles is the hormone **melatonin**. The **pineal gland**, an endocrine structure located inside the brain that releases melatonin, is thought to be involved in the regulation of various biological rhythms and of the immune system during sleep (Hardeland et al., 2006). Melatonin release is stimulated by darkness and inhibited by light.

There are individual differences with regards to our sleep-wake cycle. For instance, some people would say they are morning people, while others would consider themselves to be night owls. These individual differences in circadian patterns of activity are known as a person's chronotype, and research demonstrates that morning larks and night owls differ with regard to sleep regulation (Taillard et al., 2003). **Sleep regulation** refers to the brain's control of switching between sleep and wakefulness as well as coordinating this cycle with the outside world.

LINK TO LEARNING

Watch this brief video describing circadian rhythms and how they affect sleep.

Disruptions of Normal Sleep

Whether lark, owl, or somewhere in between, there are situations in which a person's circadian clock gets out of synchrony with the external environment. One way that this happens involves traveling across multiple time zones. When we do this, we often experience jet lag. **Jet lag** is a collection of symptoms that results from the mismatch between our internal circadian cycles and our environment. These symptoms include fatigue, sluggishness, irritability, and **insomnia** (i.e., a consistent difficulty in falling or staying asleep for at least three nights a week over a month's time) (Roth, 2007).

Individuals who do rotating shift work are also likely to experience disruptions in circadian cycles. **Rotating shift work** refers to a work schedule that changes from early to late on a daily or weekly basis. For example, a person may work from 7:00 a.m. to 3:00 p.m. on Monday, 3:00 a.m. to 11:00 a.m. on Tuesday, and 11:00 a.m. to 7:00 p.m. on Wednesday. In such instances, the individual's schedule changes so frequently that it becomes difficult for a normal circadian rhythm to be maintained. This often results in sleeping problems, and it can lead to signs of depression and anxiety. These kinds of schedules are common for individuals working in health care professions and service industries, and they are associated with persistent feelings of exhaustion and agitation that can make someone more prone to making mistakes on the job (Gold et al., 1992; Presser, 1995).

Rotating shift work has pervasive effects on the lives and experiences of individuals engaged in that kind of work, which is clearly illustrated in stories reported in a qualitative study that researched the experiences of middle-aged nurses who worked rotating shifts (West et al., 2009). Several of the nurses interviewed commented that their work schedules affected their relationships with their family. One of the nurses said,

> If you've had a partner who does work regular job 9 to 5 office hours . . . the ability to spend time, good time with them when you're not feeling absolutely exhausted . . . that would be one of the problems that I've encountered. (West et al., 2009, p. 114)

While disruptions in circadian rhythms can have negative consequences, there are things we can do to help us realign our biological clocks with the external environment. Some

FIGURE 9.3. Devices like this are designed to provide exposure to bright light to help people maintain a regular circadian cycle. They can be helpful for people working night shifts or for people affected by seasonal variations in light. ["Light therapy lamp and sunlight" by SIllu/Wikimedia Commons is in the public domain.]

of these approaches, such as using a bright light as shown in **FIGURE 9.3**, have been shown to alleviate some of the problems experienced by individuals suffering from jet lag or from the consequences of rotating shift work. Because the biological clock is driven by light, exposure to bright light during working shifts and dark exposure when not working can help combat insomnia and symptoms of anxiety and depression (Huang et al., 2013).

LINK TO LEARNING

Watch this video to learn tips on how to overcome jet lag.

Insufficient Sleep

When people have difficulty getting sleep due to their work or the demands of day-to-day life, they accumulate a sleep debt. A person with a **sleep debt** does not get sufficient sleep on a chronic basis. The consequences of sleep debt include decreased levels of alertness and mental efficiency. Interestingly, since the advent of electric light, the amount of sleep that people get has declined. While we certainly welcome the convenience of having the darkness lit up, we also suffer the consequences of reduced amounts of sleep because we are more active during the nighttime hours than our ancestors were. As a result, many of us sleep less than 7–8 hours a night and accrue a sleep debt. While there is tremendous variation in any given individual's sleep needs, the National Sleep Foundation (n.d.) cites research to estimate that newborns require the most sleep (between 12 and 18 hours a night) and that this amount declines to just 7–9 hours by the time we are adults.

If you lie down to take a nap and fall asleep very easily, chances are you may have sleep debt. Given that college students are notorious for suffering from significant sleep debt (Hicks et al., 1992; Hicks et al., 2001; Miller et al., 2010), chances are you and your classmates deal with sleep debt–related issues on a regular basis. In 2015, the National Sleep Foundation updated their sleep duration hours, to better accommodate individual differences. **TABLE 9.1** shows the new recommendations.

Sleep debt and sleep deprivation have significant negative psychological and physiological consequences **FIGURE 9.4**. As mentioned earlier, lack of sleep can result in decreased mental alertness and cognitive function. In addition, sleep

TABLE 9.1. Sleep Needs at Different Ages

Age	Recommended	May Be Appropriate	Not Recommended
0–3 months	14–17 hours	11–13 hours 18–19 hours	Less than 11 hours More than 19 hours
4–11 months	12–15 hours	10–11 hours 16–18 hours	Less than 10 hours More than 18 hours
1–2 years	11–14 hours	9–10 hours 15–16 hours	Less than 9 hours More than 16 hours
3–5 years	10–13 hours	8–9 hours 14 hours	Less than 8 hours More than 14 hours
6–13 years	9–11 hours	7–8 hours 12 hours	Less than 7 hours More than 12 hours
14–17 years	8–10 hours	7 hours 11 hours	Less than 7 hours More than 11 hours
18–25 years	7–9 hours	6 hours 10–11 hours	Less than 6 hours More than 11 hours
26–64 years	7–9 hours	6 hours 10 hours	Less than 6 hours More than 10 hours
≥65 years	7–8 hours	5–6 hours 9 hours	Less than 5 hours More than 9 hours

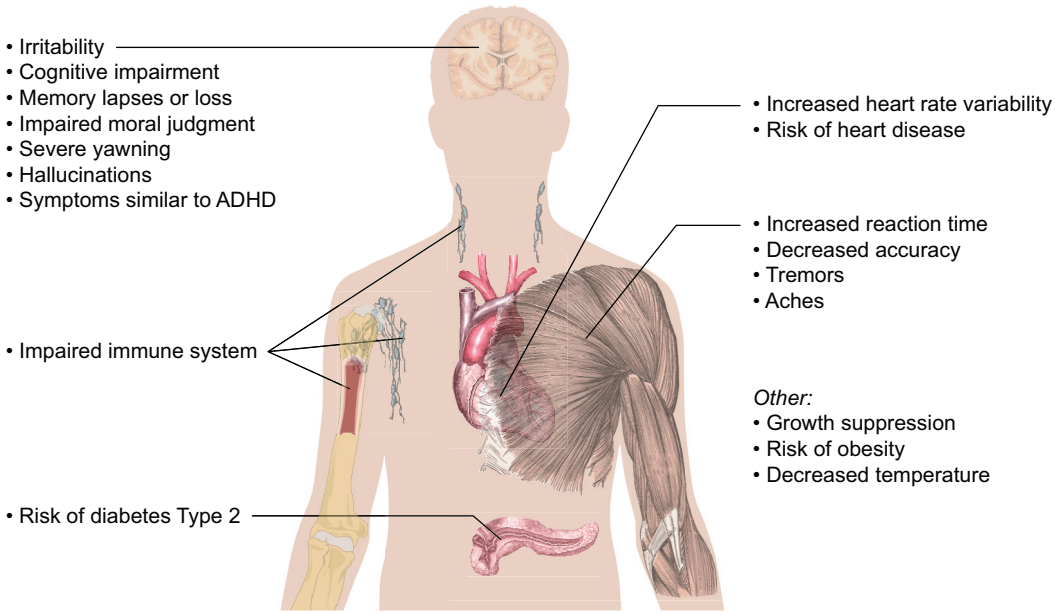


FIGURE 9.4. Some of the negative consequences of sleep deprivation. While cognitive deficits may be the most obvious, many body systems are negatively affected by lack of sleep. [This work, "Effects of Sleep Deprivation," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Effects of sleep deprivation" by Mikael Häggström/Wikimedia Commons, which is in the public domain under CC0 1.0.]

deprivation often results in depression-like symptoms. These effects can occur as a function of accumulated sleep debt or in response to more acute periods of sleep deprivation. It may surprise you to know that sleep deprivation is associated with obesity, increased blood pressure, increased levels of stress hormones, and reduced immune functioning (Banks & Dinges, 2007). A sleep deprived individual generally will fall asleep more quickly than if she were not sleep deprived. Some sleep-deprived individuals have difficulty staying awake when they stop moving (e.g., sitting and watching television or driving a car). That is why individuals suffering from sleep deprivation can put themselves and others at risk when they get behind the wheel of a car or work with dangerous machinery. Some research suggests that sleep deprivation affects cognitive and motor function as much as, if not more than, alcohol intoxication (Williamson & Feyer, 2000).

LINK TO LEARNING

To assess your own sleeping habits, read this article about sleep needs.

The amount of sleep we get varies across the lifespan. When we are very young, we spend up to 16 hours a day sleeping. As we grow older, we sleep less. In fact, a **meta-analysis**, which is a study that combines the results of many related studies, conducted within the last decade indicates that by the time we are 65 years old, we average fewer than 7 hours of sleep per day (Ohayon et al., 2004). As the amount of time we sleep varies over our lifespan, presumably the sleep debt would adjust accordingly.

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READING 10

Sleep and Why We Sleep

SOURCE

OpenStax. (2019). *Psychology.* OpenStax CNX. https://openstax.org/details/books/psychology

LEARNING OBJECTIVES

- Describe areas of the brain involved in sleep.
- Understand hormone secretions associated with sleep.
- Describe several theories aimed at explaining the function of sleep.

KEY TERMS

evolutionary psychology
sleep rebound

We spend approximately one-third of our lives sleeping. Given that the average life expectancy for U.S. citizens falls between 73 and 79 years old (Singh & Siahpush, 2006), we can expect to spend approximately 25 years of our lives sleeping. Some animals never sleep (e.g., several fish and amphibian species); other animals can go extended periods of time without sleep and without apparent negative consequences (e.g., dolphins); yet some animals (e.g., rats) die after two weeks of sleep deprivation (Siegel, 2008). Why do we devote so much time to sleeping? Is it absolutely essential that we sleep? This section will consider these questions and explore various explanations for why we sleep.

WHAT IS SLEEP?

You have read that sleep is distinguished by low levels of physical activity and reduced sensory awareness. As discussed by Siegel (2008), a definition of sleep must also include mention of the interplay of the circadian and homeostatic mechanisms that regulate sleep. Homeostatic regulation of sleep is evidenced by sleep rebound following sleep deprivation. **Sleep rebound** refers to the fact that a sleep-deprived individual will tend to take a shorter time to fall asleep during subsequent opportunities for sleep. Sleep is characterized by certain patterns of activity of the brain that can be visualized using electroencephalography (EEG), and different phases of sleep can be differentiated using EEG as well (**FIGURE 10.1**).

Sleep-wake cycles seem to be controlled by multiple brain areas acting in conjunction with one another. Some of these areas include the thalamus, the hypothalamus, and the pons. As already mentioned, the hypothalamus contains the SCN—the biological clock of the body—in addition to other nuclei that, in conjunction with the thalamus, regulate slow-wave sleep. The pons is important for regulating rapid eye movement (REM) sleep (National Institutes of Health, 2007).

Sleep is also associated with the secretion and regulation of a number of hormones from several endocrine glands, including melatonin, follicle stimulating hormone (FSH), luteinizing hormone (LH), and growth hormone (National Institutes of Health, 2007). You have read that the pineal gland releases melatonin during sleep (**FIGURE 10.2**). Melatonin is thought to be involved in the regulation of various biological rhythms and the immune system (Hardeland et al.,

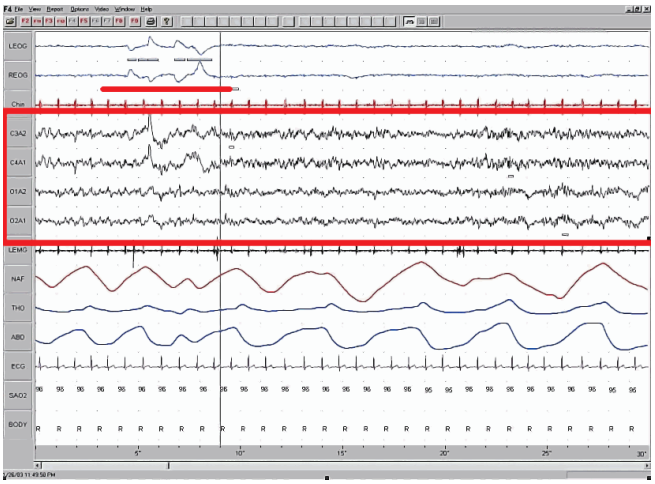

FIGURE 10.1. A segment of a polysonograph (PSG), a recording of several physical variables during sleep. The *x*-axis shows passage of time in seconds; this record includes 30 seconds of data. The location of the sets of electrode that produced each signal is labeled on the *y*-axis. The red box encompasses EEG output, and the waveforms are characteristic of a specific stage of sleep. Other curves show other sleep-related data, such as body temperature, muscle activity, and heartbeat. ["Sleep EEG REM" by MrSandman/Wikimedia Commons is in the public domain.]

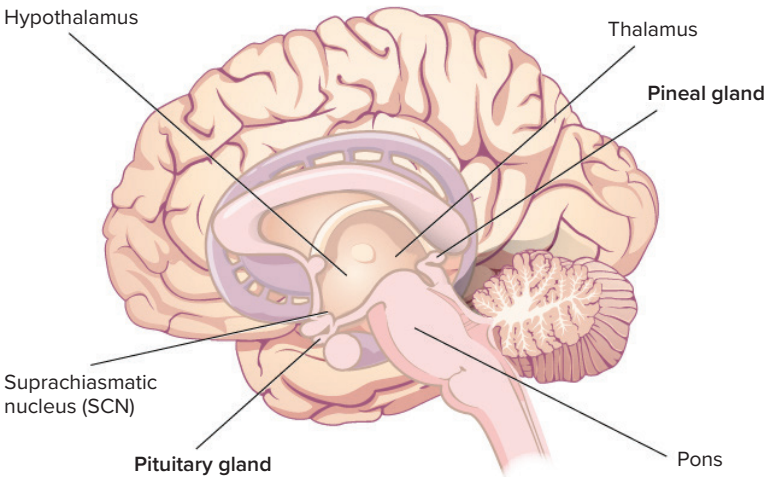

FIGURE 10.2. The pineal and pituitary glands secrete a number of hormones during sleep. [This work, "Pineal and Pituitary Glands," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Figure 4.7"/OpenStax, which is licensed under CC BY 4.0.]

2006). During sleep, the pituitary gland secretes both FSH and LH which are important in regulating the reproductive system (Christensen et al., 2012; Sofikitis et al., 2008). The pituitary gland also secretes growth hormone during sleep, which plays a role in physical growth and maturation as well as other metabolic processes (Bartke et al., 2013).

WHY DO WE SLEEP?

Given the central role that sleep plays in our lives and the number of adverse consequences that have been associated with sleep deprivation, one would think that we would have a clear understanding of why it is that we sleep. Unfortunately, this is not the case; however, several hypotheses have been proposed to explain the function of sleep.

Adaptive Function of Sleep

One popular hypothesis of sleep incorporates the perspective of evolutionary psychology. **Evolutionary psychology** is a discipline that studies how universal patterns of behavior and cognitive processes have evolved over time as a result of natural selection. Variations and adaptations in cognition and behavior make individuals more or less successful in reproducing and passing their genes to their offspring. One hypothesis from this perspective might argue that sleep is essential to restore resources that are expended during the day. Just as bears hibernate in the winter when resources are scarce, perhaps people sleep at night to reduce their energy expenditures. While this is an intuitive explanation of sleep, there is little research that supports this explanation. In fact, it has been suggested that there is no reason to think that energetic demands could not be addressed with periods of rest and inactivity (Frank, 2006; Rial et al., 2007), and some research has actually found a negative correlation between energetic demands and the amount of time spent sleeping (Capellini et al., 2008).

Another evolutionary hypothesis of sleep holds that our sleep patterns evolved as an adaptive response to predatory risks, which increase in darkness. Thus we sleep in safe areas to reduce the chance of harm. Again, this is an intuitive and appealing explanation for why we sleep. Perhaps our ancestors spent extended periods of time asleep to reduce attention to themselves from potential predators. Comparative research indicates, however, that the relationship that exists between predatory risk and sleep is very complex and equivocal. Some research suggests that species that face higher predatory risks sleep fewer hours than other species (Capellini et al., 2008), while other researchers suggest there is no relationship between the amount of time a given species spends in deep sleep and its predation risk (Lesku et al., 2006).

It is quite possible that sleep serves no single universally adaptive function, and different species have evolved different patterns of sleep in response to their unique evolutionary pressures. While we have discussed the negative outcomes associated with sleep deprivation, it should be pointed out that there are many benefits that are associated with adequate amounts of sleep. A few such benefits listed by the National Sleep Foundation (n.d.) include maintaining healthy weight, lowering stress levels, improving mood, and increasing motor coordination, as well as a number of benefits related to cognition and memory formation.

Cognitive Function of Sleep

Another theory regarding why we sleep involves sleep's importance for cognitive function and memory formation (Rattenborg et al., 2007). Indeed, we know sleep deprivation results in disruptions in cognition and memory deficits (Brown, 2012), leading to impairments in our abilities to maintain attention, make decisions, and recall long-term memories. Moreover, these impairments become more severe as the amount of sleep deprivation increases (Alhola & Polo-Kantola, 2007).

Furthermore, slow-wave sleep after learning a new task can improve resultant performance on that task (Huber et al., 2004) and seems essential for effective memory formation (Stickgold, 2005). Understanding the impact of sleep on cognitive function should help you understand that cramming all night for a test may be not effective and can even prove counterproductive.

LINK TO LEARNING

Watch this brief video describing sleep deprivation in college students.

Here's another brief video describing sleep tips for college students.

Sleep has also been associated with other cognitive benefits. Research indicates that included among these possible benefits are increased capacities for creative thinking (Cai et al., 2009; Wagner et al., 2004), language learning (Fenn et al., 2003; Gómez et al., 2006), and inferential judgments (Ellenbogen et al., 2007). It is possible that even the processing of emotional information is influenced by certain aspects of sleep (Walker, 2009).

LINK TO LEARNING

Watch this brief video describing the relationship between sleep and memory.

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READING 11

Stages of Sleep

SOURCE

OpenStax. (2019). *Psychology.* OpenStax CNX. https://openstax.org/details/books/psychology

LEARNING OBJECTIVES

- Differentiate between REM and non-REM sleep.
- Describe the differences between the four stages of non-REM sleep.
- Understand the role that REM and non-REM sleep play in learning and memory.

KEY TERMS

alpha waves
collective unconscious
delta waves
K-complex
latent content
lucid dreams
manifest content
non-REM (NREM)
rapid eye movement (REM)
sleep spindle
stage 1 sleep
stage 2 sleep
stage 3 sleep
stage 4 sleep
theta waves

Sleep is not a uniform state of being. Instead, sleep is composed of several different stages that can be differentiated from one another by the patterns of brain wave activity that occur during each stage. These changes in brain wave activity can be visualized using EEG and are distinguished from one another by both the frequency and amplitude of brain waves (FIGURE 11.1). Sleep can be divided into two different general phases: REM sleep and non-REM sleep. **Rapid eye movement (REM)** sleep is characterized by darting movements of the eyes under closed eyelids. Brain waves during REM sleep appear very similar to brain waves during wakefulness. In contrast, **non-REM (NREM)** sleep is subdivided into four stages distinguished from each other and from wakefulness by characteristic patterns of brain waves. The first four stages of sleep are NREM sleep, while the fifth and final stage of sleep is REM sleep. In this section, we will discuss each of these stages of sleep and their associated patterns of brain wave activity.

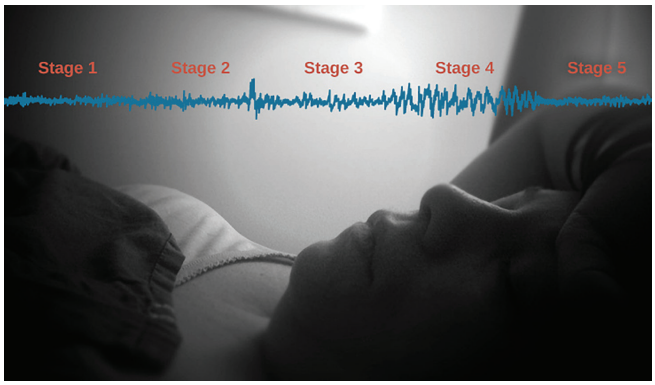


FIGURE 11.1. Brainwave activity changes dramatically across the different stages of sleep. ["This work, "sleeping," is licensed under CC BY 4.0 by OpenStax. It is a derivative of "Perchance" by Ryan Vaarsi/ Flickr, which is licensed under CC BY 2.0.]

NREM STAGES OF SLEEP

The first stage of NREM sleep is known as stage 1 sleep. **Stage 1 sleep** is a transitional phase that occurs between wakefulness and sleep, the period during which we drift off to sleep. During this time, there is a slowdown in both the rates of respiration and heartbeat. In addition, stage 1 sleep involves a marked decrease in both overall muscle tension and core body temperature.

In terms of brain wave activity, stage 1 sleep is associated with both alpha and theta waves. The early portion of stage 1 sleep produces **alpha waves**, which are relatively low frequency (8–13 Hz), high amplitude patterns of electrical activity (waves) that become synchronized (FIGURE 11.2). This pattern of brain wave activity resembles that of someone who is very relaxed, yet awake. As an individual continues through stage 1 sleep, there is an increase in theta wave activity. **Theta waves** are even lower frequency (4–7 Hz), higher amplitude brain waves than alpha waves. It is relatively easy to wake someone from stage 1 sleep; in fact, people often report that they have not been asleep if they are awoken during stage 1 sleep.

As we move into **stage 2 sleep**, the body goes into a state of deep relaxation. Theta waves still dominate the activity of the brain, but they are interrupted by brief bursts of activity known as sleep spindles (FIGURE 11.3). A **sleep spindle** is a rapid burst of higher frequency brain waves that may be

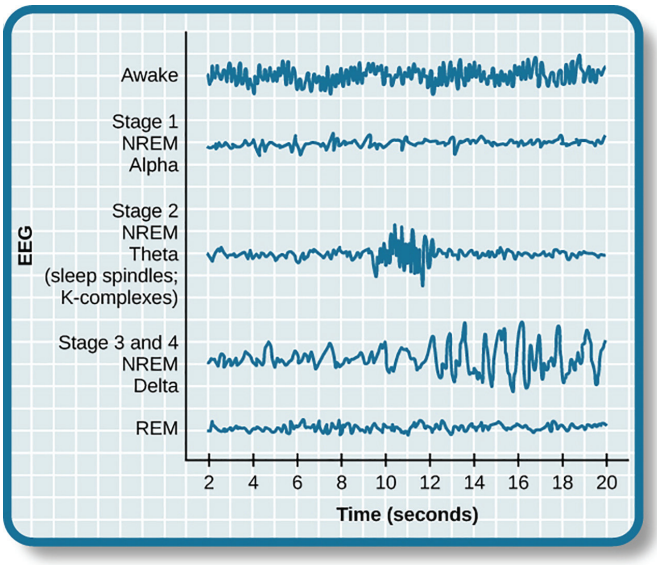


FIGURE 11.2. Brainwave activity changes dramatically across the different stages of sleep. ["Figure 4.9"/OpenStax is licensed under CC BY 4.0.]

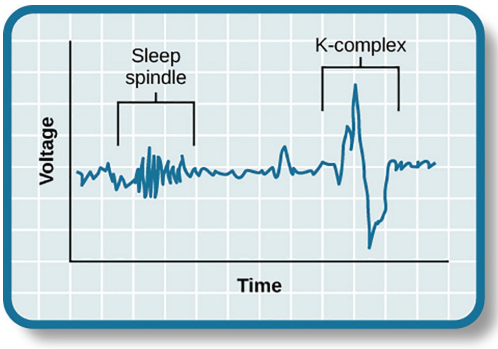


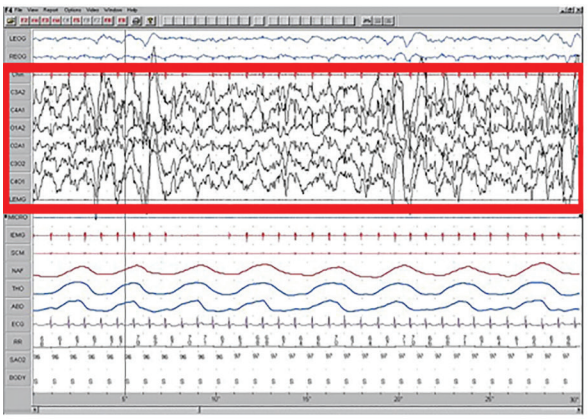
FIGURE 11.3. Stage 2 sleep is characterized by the appearance of both sleep spindles and K-complexes. ["Figure 4.10"/OpenStax is licensed under CC BY 4.0.]

important for learning and memory (Fogel & Smith, 2011; Poe et al., 2010). In addition, the appearance of K-complexes is often associated with stage 2 sleep. A **K-complex** is a very high amplitude pattern of brain activity that may in some cases occur in response to environmental stimuli. Thus, K-complexes might serve as a bridge to higher levels of arousal in response to what is going on in our environments (Halász, 1993; Steriade & Amzica, 1998).

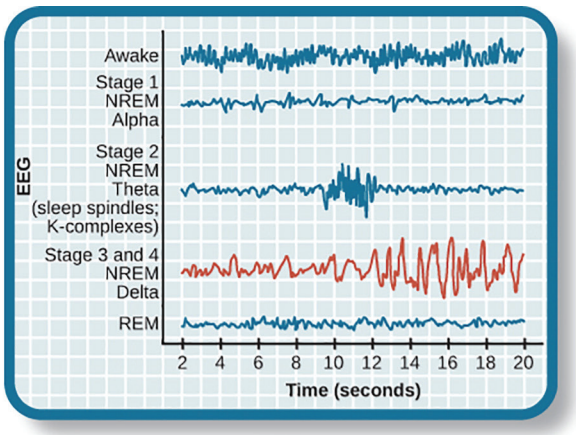
Stage 3 and **stage 4** of sleep are often referred to as deep sleep or slow-wave sleep because these stages are characterized by low frequency (up to 4 Hz), high amplitude **delta waves** (FIGURE 11.4). During this time, an individual's heart rate and respiration slow dramatically. It is much more difficult to awaken someone from sleep during stage 3 and stage 4 than during earlier stages. Interestingly, individuals who have increased levels of alpha brain wave activity (more often associated with wakefulness and transition into stage 1 sleep) during stage 3 and stage 4 often report that they do not feel refreshed upon waking, regardless of how long they slept (Stone et al., 2008).

REM SLEEP

As mentioned earlier, REM sleep is marked by rapid movements of the eyes. The brain waves associated with this stage of sleep are very similar to those observed when a person is awake, as shown in FIGURE 11.5, and this is the period of sleep in which dreaming occurs. It is also associated with paralysis of muscle systems in the body with the exception of those that make circulation and respiration possible. Therefore, no movement of voluntary muscles occurs during REM sleep in a normal individual; REM sleep is often referred to as paradoxical sleep because of this combination of high brain activity and lack of muscle tone. Like NREM sleep, REM has been implicated in various aspects of learning and memory (Wagner et al., 2001), although there is disagreement within the scientific



(a)



(b)

FIGURE 11.4. (a) Delta waves, which are low frequency and high amplitude, characterize (b) slow-wave stage 3 and stage 4 sleep. ["Figure 4.11"/OpenStax is licensed under CC BY 4.0.]

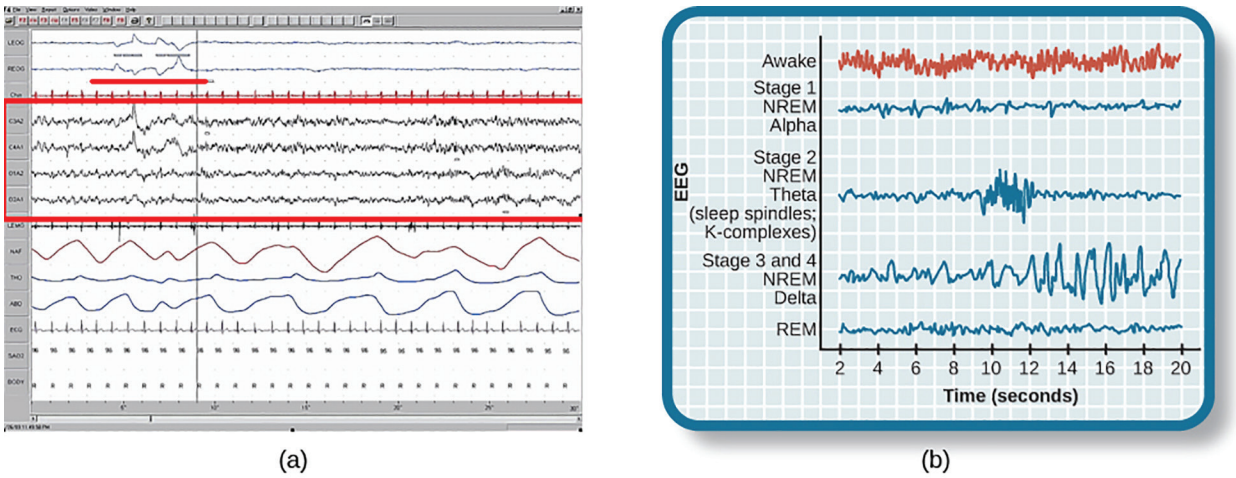


FIGURE 11.5. (a) A period of rapid eye movement is marked by the short red line segment. The brain waves associated with REM sleep, outlined in the red box in (a), look very similar to those seen (b) during wakefulness. ["Figure 4.12"/OpenStax is licensed under CC BY 4.0.]

community about how important both NREM and REM sleep are for normal learning and memory (Siegel, 2001).

If people are deprived of REM sleep and then allowed to sleep without disturbance, they will spend more time in REM sleep in what would appear to be an effort to recoup the lost time in REM. This is known as the REM rebound, and it suggests that REM sleep is also homeostatically regulated. Aside from the role that REM sleep may play in processes related to learning and memory, REM sleep may also be involved in emotional processing and regulation. In such instances, REM rebound may actually represent an adaptive response to stress in nondepressed individuals by suppressing the emotional salience of aversive events that occurred in wakefulness (Suchecki et al., 2012).

While sleep deprivation in general is associated with a number of negative consequences (Brown, 2012), the consequences of REM deprivation appear to be less profound (as discussed in Siegel, 2001). In fact, some have suggested that REM deprivation can actually be beneficial in some circumstances. For instance, REM sleep deprivation has been demonstrated to improve symptoms of people suffering from major depression, and many effective antidepressant medications suppress REM sleep (Riemann et al., 2001; Vogel, 1975).

It should be pointed out that some reviews of the literature challenge this finding, suggesting that sleep deprivation that is not limited to REM sleep is just as effective or more effective at alleviating depressive symptoms among some patients suffering from depression. In either case, why sleep deprivation improves the mood of some patients is not entirely understood (Giedke & Schwärzler, 2002). Recently, however, some have suggested that sleep deprivation might change emotional processing so that various stimuli are more likely to be perceived as positive in nature (Gujar et al., 2011).

The hypnogram below (**FIGURE 11.6**) shows a person's passage through the stages of sleep.

LINK TO LEARNING

View this video that describes the various stages of sleep.

Dreams

The meaning of dreams varies across different cultures and periods of time. By the late nineteenth century, German psychiatrist Sigmund Freud had become convinced that dreams represented an opportunity to gain access to the unconscious. By analyzing dreams, Freud thought people could increase self-awareness and gain valuable insight to help them deal with the problems they faced in their lives. Freud made

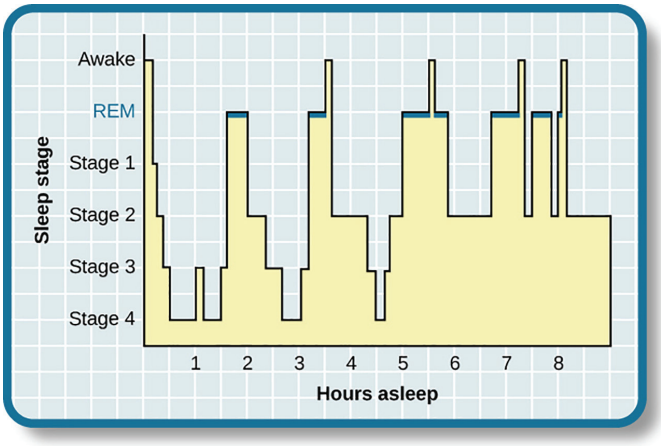


FIGURE 11.6. A hypnogram is a diagram of the stages of sleep as they occur during a period of sleep. This hypnogram illustrates how an individual moves through the various stages of sleep. ["Figure 4.13"/OpenStax is licensed under CC BY 4.0.]

distinctions between the manifest content and the latent content of dreams. **Manifest content** is the actual content, or storyline, of a dream. **Latent content**, on the other hand, refers to the hidden meaning of a dream. For instance, if a woman dreams about being chased by a snake, Freud might have argued that this represents the woman's fear of sexual intimacy, with the snake serving as a symbol of a man's penis.

Freud was not the only theorist to focus on the content of dreams. The twentieth century Swiss psychiatrist Carl Jung believed that dreams allowed us to tap into the collective unconscious. The **collective unconscious**, as described by Jung, is a theoretical repository of information he believed to be shared by everyone. According to Jung, certain symbols in dreams reflected universal archetypes with meanings that are similar for all people regardless of culture or location.

The sleep and dreaming researcher Rosalind Cartwright, however, believes that dreams simply reflect life events that are important to the dreamer. Unlike Freud and Jung, Cartwright's ideas about dreaming have found empirical support. For example, she and her colleagues published a study in which women going through divorce were asked several times over a five-month period to report the degree to which their former spouses were on their minds. These same women were awakened during REM sleep in order to provide a detailed account of their dream content. There was a significant positive correlation between the degree to which women thought about their former spouses during waking hours and the number of times their former spouses appeared as characters in their dreams (Cartwright et al., 2006). Recent research (Horikawa et al., 2013) has uncovered new techniques by which researchers may effectively detect and classify the visual images that occur during dreaming by using fMRI for neural measurement of brain activity patterns, opening the way for additional research in this area.

Recently, neuroscientists have also become interested in understanding why we dream. For example, John Hobson (2009) suggests that dreaming may represent a state of protoconsciousness. In other words, dreaming involves constructing a virtual reality in our heads that we might use to help us during wakefulness. Among a variety of neurobiological evidence, Hobson cites research on lucid dreams as an opportunity to better understand dreaming in general. **Lucid dreams** are dreams in which certain aspects of wakefulness are maintained during a dream state. In a lucid dream, a person becomes aware of the fact that they are dreaming, and as such, they can control the dream's content (LaBerge, 1990).

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READING 12

Sleep Problems and Disorders

SOURCE

OpenStax. (2019). *Psychology.* OpenStax CNX. https://openstax.org/details/books/psychology

LEARNING OBJECTIVES

- Describe the symptoms and treatments of insomnia.
- Recognize the symptoms of several parasomnias.
- Describe the symptoms and treatments for sleep apnea.
- Recognize risk factors associated with sudden infant death syndrome (SIDS) and steps to prevent it.
- Describe the symptoms and treatments for narcolepsy.

KEY TERMS

cataplexy
central sleep apnea
cognitive-behavioral therapy
continuous positive airway pressure (CPAP)
narcolepsy
night terrors
obstructive sleep apnea
parasomnia
REM sleep behavior disorder (RBD)
restless leg syndrome
sleep apnea
sleepwalking
sudden infant death syndrome (SIDS)

Many people experience disturbances in their sleep at some point in their lives. Depending on the population and sleep disorder being studied, between 30% and 50% of the population suffers from a sleep disorder at some point in their lives (Bixler et al., 1979; Hossain & Shapiro, 2002; Ohayon, 1997, 2002; Ohayon & Roth, 2002). This section will describe several sleep disorders as well as some of their treatment options.

INSOMNIA

Insomnia, a consistent difficulty in falling or staying asleep, is the most common of the sleep disorders. Individuals with insomnia often experience long delays between the times that they go to bed and actually fall asleep. In addition, these individuals may wake up several times during the night only to find that they have difficulty getting back to sleep. As mentioned earlier, one of the criteria for insomnia involves experiencing these symptoms for at least three nights a week for at least one month's time (Roth, 2007).

It is not uncommon for people suffering from insomnia to experience increased levels of anxiety about their inability to fall asleep. This becomes a self-perpetuating cycle because increased anxiety leads to increased arousal, and higher levels of arousal make the prospect of falling asleep even more unlikely. Chronic insomnia is almost always associated with feeling overtired and may be associated with symptoms of depression.

There may be many factors that contribute to insomnia, including age, drug use, exercise, mental status, and bedtime routines. Not surprisingly, insomnia treatment may take one of several different approaches. People who suffer from insomnia might limit their use of stimulant drugs (such as caffeine) or increase their amount of physical exercise during the day. Some people might turn to over-the-counter (OTC) or prescribed sleep medications to help them sleep, but this should be done sparingly because many sleep medications result in dependence and alter the nature of the sleep cycle, and they can increase insomnia over time. Those who continue to have insomnia, particularly if it affects their quality of life, should seek professional treatment.

Some forms of psychotherapy, such as cognitive-behavioral therapy, can help sufferers of insomnia. **Cognitive-behavioral therapy** is a type of psychotherapy that focuses on cognitive processes and problem behaviors. The treatment of insomnia likely would include stress management techniques and changes in problematic behaviors that could contribute to insomnia (e.g., spending more waking time in bed). Cognitive-behavioral therapy has been demonstrated to be quite effective in treating insomnia (Savard et al., 2005; Williams et al., 2013).

PARASOMNIAS

A **parasomnia** is one of a group of sleep disorders in which unwanted, disruptive motor activity and/or experiences during sleep play a role. Parasomnias can occur in either REM or NREM phases of sleep. Sleepwalking, restless leg syndrome, and night terrors are all examples of parasomnias (Mahowald & Schenck, 2000).

Sleepwalking

In **sleepwalking**, or somnambulism, the sleeper engages in relatively complex behaviors ranging from wandering about

DIG DEEPER

A Sleepwalking Defense?

On January 16, 1997, Scott Falater sat down to dinner with his wife and children and told them about difficulties he was experiencing on a project at work. After dinner, he prepared some materials to use in leading a church youth group the following morning, and then he attempted to repair the family's swimming pool pump before retiring to bed. The following morning, he awoke to barking dogs and unfamiliar voices from downstairs. As he went to investigate what was going on, he was met by a group of police officers who arrested him for the murder of his wife (Cartwright, 2004; CNN, 1999).

Yarmila Falater's body was found in the family's pool with 44 stab wounds. A neighbor called the police after witnessing Falater standing over his wife's body before dragging her into the pool. Upon a search of the premises, police found blood-stained clothes and a bloody knife in the trunk of Falater's car, and he had blood stains on his neck.

Remarkably, Falater insisted that he had no recollection of hurting his wife in any way. His children and his wife's parents all agreed that Falater had an excellent relationship with his wife and they couldn't think of a reason that would provide any sort of motive to murder her (Cartwright, 2004).

Scott Falater had a history of regular episodes of sleepwalking as a child, and he had even behaved violently toward his sister once when she tried to prevent him from leaving their home in his pajamas during a sleepwalking episode. He suffered from no apparent anatomical brain anomalies or psychological disorders. It appeared that Scott Falater had killed his wife in his sleep, or at least, that is the defense he used when he was tried for his wife's murder (Cartwright, 2004; CNN, 1999). In Falater's case, a jury found him guilty of first degree murder in June of 1999 (CNN, 1999); however, there are other murder cases where the sleepwalking defense has been used successfully. As scary as it sounds, many sleep researchers believe that homicidal sleepwalking is possible in individuals suffering from the types of sleep disorders described in this module (Broughton et al., 1994; Cartwright, 2004; Mahowald et al., 2005; Pressman, 2007). ■

to driving an automobile. During periods of sleepwalking, sleepers often have their eyes open, but they are not responsive to attempts to communicate with them. Sleepwalking most often occurs during slow-wave sleep, but it can occur at any time during a sleep period in some affected individuals (Mahowald & Schenck, 2000).

Historically, somnambulism has been treated with a variety of pharmacotherapies ranging from benzodiazepines to antidepressants. However, the success rate of such treatments is questionable. Guilleminault et al. (2005) found that sleepwalking was not alleviated with the use of benzodiazepines. However, all of their somnambulistic patients who also suffered from sleep-related breathing problems showed a marked decrease in sleepwalking when their breathing problems were effectively treated.

REM Sleep Behavior Disorder (RBD)

REM sleep behavior disorder (RBD) occurs when the muscle paralysis associated with the REM sleep phase does not occur. Individuals who suffer from RBD have high levels of physical activity during REM sleep, especially during disturbing dreams. These behaviors vary widely, but they can include kicking, punching, scratching, yelling, and behaving like an animal that has been frightened or attacked. People who suffer from this disorder can injure themselves or their sleeping partners when engaging in these behaviors. Furthermore, these types of behaviors ultimately disrupt sleep, although affected individuals have no memories that these behaviors have occurred (Arnulf, 2012).

This disorder is associated with a number of neurodegenerative diseases such as Parkinson's disease. In fact, this relationship is so robust that some view the presence of RBD as a potential aid in the diagnosis and treatment of a number of neurodegenerative diseases (Ferini-Strambi, 2011). Clonazepam, an anti-anxiety medication with sedative properties, is most often used to treat RBD. It is administered alone or in conjunction with doses of melatonin (the hormone secreted by the pineal gland). As part of treatment, the sleeping environment is often modified to make it a safer place for those suffering from RBD (Zanigni et al., 2011).

Other Parasomnias

A person with **restless leg syndrome** has uncomfortable sensations in the legs during periods of inactivity or when trying to fall asleep. This discomfort is relieved by deliberately moving the legs, which, not surprisingly, contributes to difficulty in falling or staying asleep. Restless leg syndrome is quite common and has been associated with a number of other medical diagnoses, such as chronic kidney disease and diabetes (Mahowald & Schenck, 2000). There are a variety of drugs that treat restless leg syndrome: benzodiazepines, opiates, and anticonvulsants (Restless Legs Syndrome Foundation, n.d.).

Night terrors result in a sense of panic in the sufferer and are often accompanied by screams and attempts to escape from the immediate environment (Mahowald & Schenck, 2000). Although individuals suffering from night terrors appear to be awake, they generally have no memories of the events that occurred, and attempts to console them are ineffective.

Typically, individuals suffering from night terrors will fall back asleep again within a short time. Night terrors apparently occur during the NREM phase of sleep (Provini et al., 2011). Generally, treatment for night terrors is unnecessary unless there is some underlying medical or psychological condition that is contributing to the night terrors (Mayo Clinic, n.d.).

SLEEP APNEA

Sleep apnea is defined by episodes during which a sleeper's breathing stops. These episodes can last 10–20 seconds or longer and often are associated with brief periods of arousal. While individuals suffering from sleep apnea may not be aware of these repeated disruptions in sleep, they do experience increased levels of fatigue. Many individuals diagnosed with sleep apnea first seek treatment because their sleeping partners indicate that they snore loudly and/or stop breathing for extended periods of time while sleeping (Henry & Rosenthal, 2013). Sleep apnea is much more common in overweight people and is often associated with loud snoring. Surprisingly, sleep apnea may exacerbate cardiovascular disease (Sánchez-de-la-Torre et al., 2012). While sleep apnea is less common in thin people, anyone, regardless of their weight, who snores loudly or gasps for air while sleeping should be checked for sleep apnea.

While people are often unaware of their sleep apnea, they are keenly aware of some of the adverse consequences of insufficient sleep. Consider a patient who believed that as a result of his sleep apnea he "had three car accidents in six weeks. They were ALL my fault. Two of them I didn't even know I was involved in until afterwards" (Henry & Rosenthal, 2013, p. 52). It is not uncommon for people suffering from undiagnosed or untreated sleep apnea to fear that their careers will be affected by the lack of sleep, illustrated by this statement from another patient: "I'm in a job where there's a premium on being mentally alert. I was really sleepy and having trouble concentrating. It was getting to the point where it was kind of scary" (Henry & Rosenthal, 2013, p. 52).

There are two types of sleep apnea: obstructive sleep apnea and central sleep apnea. **Obstructive sleep apnea** occurs when an individual's airway becomes blocked during sleep, and air is prevented from entering the lungs. In **central sleep apnea**, disruption in signals sent from the brain that regulate breathing cause periods of interrupted breathing (White, 2005).

One of the most common treatments for sleep apnea involves the use of a special device during sleep. A **continuous positive airway pressure (CPAP)** device includes a mask that fits over the sleeper's nose and mouth, which is connected to a pump that pumps air into the person's airways, forcing them to remain open, as shown in **FIGURE 12.1**. Some newer CPAP masks are smaller and cover only the nose. This treatment option has proven to be effective for people suffering from mild to severe cases of sleep apnea (McDaid et al., 2009). However, alternative treatment options are being explored because consistent compliance by users of CPAP devices is a problem. Recently, a new EPAP (expiratory positive air pressure) device has shown promise in double-blind trials as one such alternative (Berry et al., 2011).

SIDS

In **sudden infant death syndrome (SIDS)** an infant stops breathing during sleep and dies. Infants younger than

(a) (b)

FIGURE 12.1. (a) A typical CPAP device used in the treatment of sleep apnea is (b) affixed to the head with straps, and a mask covers the nose and mouth. [(a) "CPAP Therapy Device" by Benutzer:DL5MDA/Wikimedia Commons is in the public domain. (b) "Full face cpap mask" by JoJoJo04/Wikimedia Commons is in the public domain.]

FIGURE 12.2. The Safe to Sleep campaign educates the public about how to minimize risk factors associated with SIDS. This campaign is sponsored in part by the National Institute of Child Health and Human Development. ["Safe Sleep logo" by the National Institute of Child Health and Human Development (NICHD)/Wikimedia Commons is in the public domain.]

12 months appear to be at the highest risk for SIDS, and boys have a greater risk than girls. A number of risk factors have been associated with SIDS, including premature birth, smoking within the home, and hyperthermia. There may also be differences in both brain structure and function in infants that die from SIDS (Berkowitz, 2012; Mage & Donner, 2006; Thach, 2005).

The substantial amount of research on SIDS has led to a number of recommendations to parents to protect their children (**FIGURE 12.2**). For one, research suggests that infants should be placed on their backs when put down to sleep, and their cribs should not contain any items that pose suffocation threats, such as blankets, pillows, or padded crib bumpers (cushions that cover the bars of a crib). Infants should not have caps placed on their heads when put down to sleep in order to prevent overheating, and people in the child's household should abstain from smoking in the home. Recommendations like these have helped to decrease the number of infant deaths from SIDS in recent years (Mitchell, 2009; Task Force on Sudden Infant Death Syndrome, 2011).

NARCOLEPSY

Unlike the other sleep disorders described in this section, a person with **narcolepsy** cannot resist falling asleep at inopportune times. These sleep episodes are often associated with **cataplexy**, which is a lack of muscle tone or muscle weakness, and in some cases involves complete paralysis of the voluntary muscles. This is similar to the kind of paralysis experienced by healthy individuals during REM sleep (Burgess & Scammell, 2012; Hishikawa & Shimizu, 1995; Luppi et al., 2011). Narcoleptic episodes take on other features of REM sleep. For example, around one third of individuals diagnosed with narcolepsy experience vivid, dream-like hallucinations during narcoleptic attacks (Chokroverty, 2010).

Surprisingly, narcoleptic episodes are often triggered by states of heightened arousal or stress. The typical episode can last from a minute or two to half an hour. Once awakened from a narcoleptic attack, people report that they feel refreshed (Chokroverty, 2010). Obviously, regular narcoleptic episodes could interfere with the ability to perform one's job or complete schoolwork, and in some situations, narcolepsy can result in significant harm and injury (e.g., driving a car or operating machinery or other potentially dangerous equipment).

Generally, narcolepsy is treated using psychomotor stimulant drugs, such as amphetamines (Mignot, 2012). These drugs promote increased levels of neural activity. Narcolepsy is associated with reduced levels of the signaling molecule hypocretin in some areas of the brain (De la Herrán-Arita & Drucker-Colín, 2012; Han, 2012), and the traditional stimulant drugs do not have direct effects on this system. Therefore, it is quite likely that new medications that are developed to treat narcolepsy will be designed to target the hypocretin system.

There is a tremendous amount of variability among sufferers, both in terms of how symptoms of narcolepsy manifest and the effectiveness of currently available treatment options. This is illustrated by McCarty's (2010) case study of a 50-year-old woman who sought help for the excessive sleepiness during normal waking hours that she had experienced for several years. She indicated that she had fallen asleep at inappropriate or dangerous times, including while eating, while socializing with friends, and while driving her car. During periods of emotional arousal, the woman complained that she felt some weakness in the right side of her body. Although she did not experience any dream-like hallucinations, she was diagnosed with narcolepsy as a result of sleep testing. In her case, the fact that her cataplexy was confined to the right side of her body was quite unusual. Early attempts to treat her condition with a stimulant drug alone were unsuccessful. However, when a stimulant drug was used in conjunction with a popular antidepressant, her condition improved dramatically.

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READING 13

Seeing

SOURCE

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LEARNING OBJECTIVES

- Identify the key structures of the eye and the role they play in vision.
- Summarize how the eye and the visual cortex work together to sense and perceive the visual stimuli in the environment, including processing colors, shape, depth, and motion.

KEY TERMS

beta effect
binocular depth cues
color blindness
cones
convergence
cornea
depth cues
depth perception
feature detector neurons
fovea
gestalt
hue
iris
lens
monocular depth cues
opponent-process color theory
optic nerve
phi phenomenon
pupil
retina
rods
visual accommodation
visual cliff
wavelength
Young-Helmholtz trichromatic color theory

Whereas other animals rely primarily on hearing, smell, or touch to understand the world around them, human beings rely in large part on vision. A large part of our cerebral cortex is devoted to seeing, and we have substantial visual skills. Seeing begins when light falls on the eyes, initiating the process of transduction. Once this visual information reaches the visual cortex, it is processed by a variety of neurons that detect colors, shapes, and motion and that create meaningful perceptions out of the incoming stimuli.

The air around us is filled with a sea of *electromagnetic energy*; pulses of energy waves that can carry information from place to place. As you can see in **FIGURE 13.1**, electromagnetic

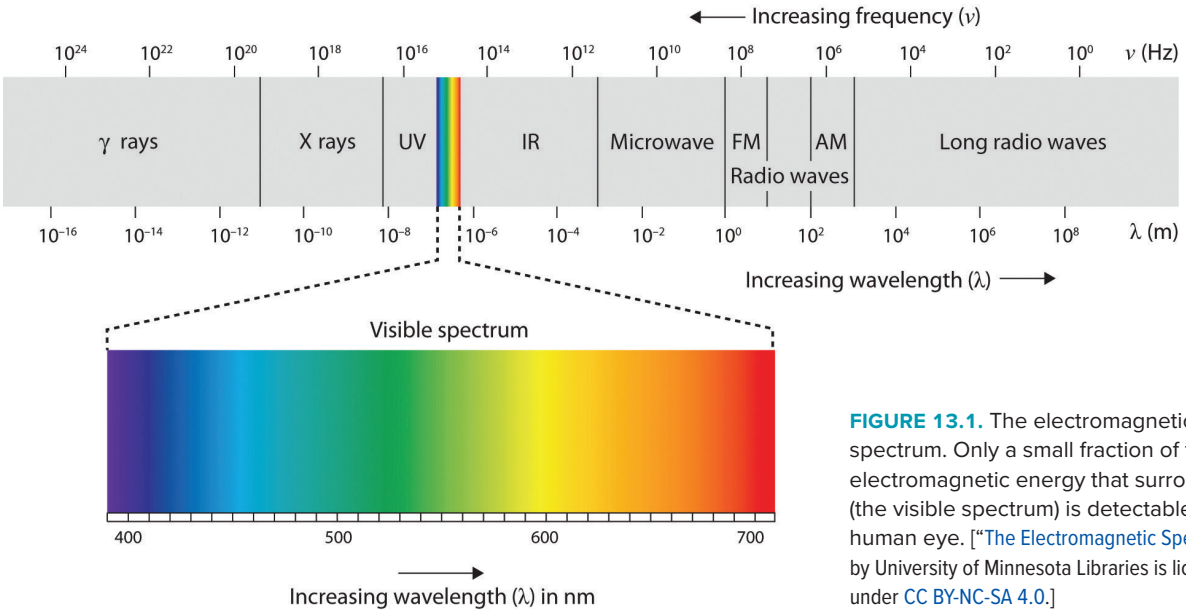


FIGURE 13.1. The electromagnetic spectrum. Only a small fraction of the electromagnetic energy that surrounds us (the visible spectrum) is detectable by the human eye. ["The Electromagnetic Spectrum" by University of Minnesota Libraries is licensed under CC BY-NC-SA 4.0.]

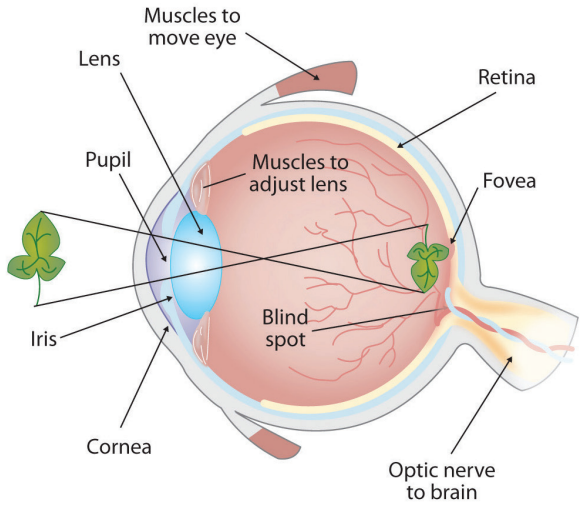


FIGURE 13.2. Anatomy of the human eye. Light enters the eye through the transparent cornea, passing through the pupil at the center of the iris. The lens adjusts to focus the light on the retina, where it appears upside down and backward. Receptor cells on the retina send information via the optic nerve to the visual cortex. ["Anatomy of the Human Eye" by University of Minnesota Libraries is licensed under CC BY-NC-SA 4.0.]

waves vary in their **wavelength**—the distance between one wave peak and the next wave peak—with the shortest gamma waves being only a fraction of a millimeter in length and the longest radio waves being hundreds of kilometers long. Humans are blind to almost all of this energy; our eyes detect only the range from about 400 to 700 billionths of a meter, the part of the electromagnetic spectrum known as the *visible spectrum*.

THE SENSING EYE AND THE PERCEIVING VISUAL CORTEX

As you can see in **FIGURE 13.2**, light enters the eye through the **cornea**, a clear covering that protects the eye and begins to focus the incoming light. The light then passes through the **pupil**, a small opening in the center of the eye. The pupil is surrounded by the **iris**, the colored part of the eye that controls the size of the pupil by constricting or dilating in response to light intensity. When we enter a dark movie theater on a sunny day, for instance, muscles in the iris open the pupil and allow more light to enter. Complete adaptation to the dark may take up to 20 minutes.

Behind the pupil is the **lens**, a structure that focuses the incoming light on the **retina**, the layer of tissue at the back of the eye that contains photoreceptor cells. As our eyes move from near objects to distant objects, a process known as visual accommodation occurs. **Visual accommodation** is the process of changing the curvature of the lens to keep the light entering the eye focused on the retina. Rays from the top of the image strike the bottom of the retina and vice versa, and rays from the left side of the image strike the right part of the retina and vice versa, causing the image on the retina to be upside down and backward. Furthermore, the image projected on the retina is flat, and yet our final perception of the image will be three dimensional.

Accommodation is not always perfect, and in some cases the light that is hitting the retina is a bit out of focus. As you can see in **FIGURE 13.3**, if the focus is in front of the retina, we say that the person is *nearsighted*, and when the focus is behind the retina we say that the person is *farsighted*. Eyeglasses and contact lenses correct this problem by adding another lens in front of the eye, and laser eye surgery corrects the problem by reshaping the eye's own lens.

The retina contains layers of neurons specialized to respond to light (see **FIGURE 13.4**). As light falls on the retina, it first activates receptor cells known as *rods* and *cones*. The activation of these cells then spreads to the *bipolar cells* and then to the *ganglion cells*, which gather together and converge, like the strands of a rope, forming the *optic nerve*. The **optic nerve** is a collection of millions of ganglion neurons that sends vast amounts of visual information, via the thalamus, to the

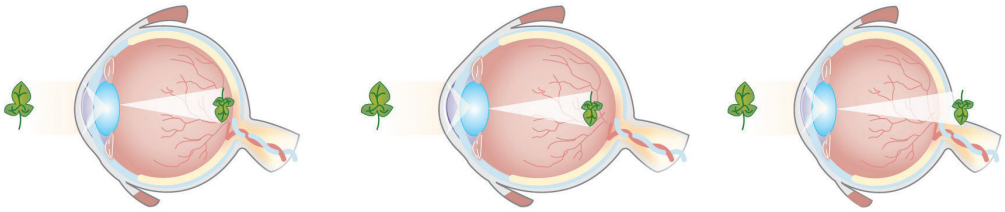


FIGURE 13.3. Normal, nearsighted, and farsighted eyes. For people with normal vision (left), the lens properly focuses incoming light on the retina. For people who are nearsighted (center), images from far objects focus too far in front of the retina, whereas for people who are farsighted (right), images from near objects focus too far behind the retina. Eyeglasses solve the problem by adding a secondary, corrective lens. ["Normal, Nearsighted, and Farsighted Eyes" by University of Minnesota Libraries is licensed under CC BY-NC-SA 4.0.]

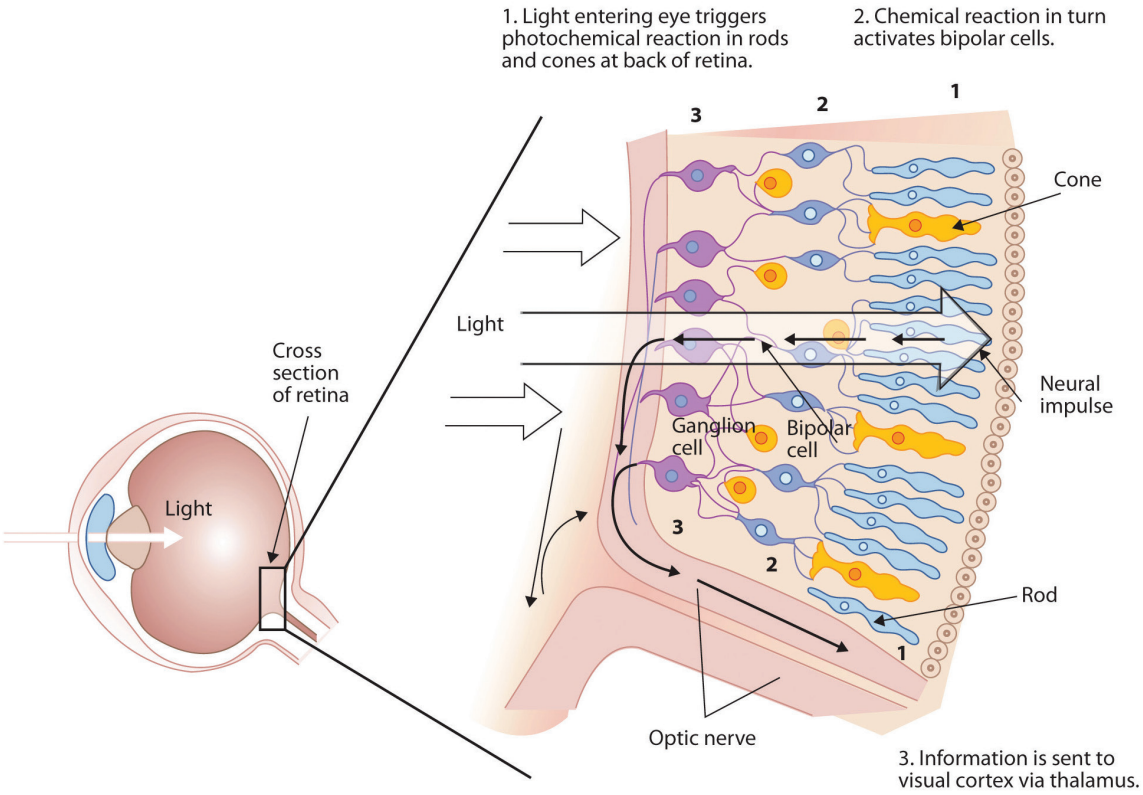
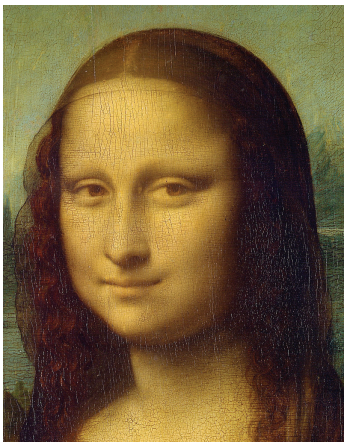


FIGURE 13.4. The retina with its specialized cells. When light falls on the retina, it creates a photochemical reaction in the rods and cones at the back of the retina. The reactions then continue to the bipolar cells, the ganglion cells, and eventually to the optic nerve. ["The Retina With Its Specialized Cells" by University of Minnesota Libraries is licensed under CC BY-NC-SA 4.0.]

brain. Because the retina and the optic nerve are active processors and analyzers of visual information, it is not inappropriate to think of these structures as an extension of the brain itself.

Rods are visual neurons that specialize in detecting black, white, and gray colors. There are about 120 million rods in each eye. The rods do not provide a lot of detail about the images we see, but because they are highly sensitive to shorter-waved (darker) and weak light, they help us see in dim light, for instance, at night. Because the rods are located primarily around the edges of the retina, they are particularly active in peripheral vision (when you need to see something at night, try looking away from what you want to see). **Cones** are visual neurons that are specialized in detecting fine detail and colors. The 5 million or so cones in each eye enable us to see in color, but they operate best in bright light. The cones are located primarily in and around the **fovea**, which is the central point of the retina.

To demonstrate the difference between rods and cones in attention to detail, choose a word in this text and focus on it. Do you notice that the words a few inches to the side seem more blurred? This is because the word you are focusing on strikes the detail-oriented cones, while the words surrounding it strike the less-detail-oriented rods, which are located on the periphery.



Mona Lisa's smile. Margaret Livingstone (2000) found an interesting effect that demonstrates the different processing capacities of the eye's rods and cones—namely, that the Mona Lisa's smile, which is widely referred to as "elusive," is perceived differently depending on how one looks at the painting. Because Leonardo da Vinci painted the smile in low-detail brush strokes, these details are better perceived by our peripheral vision (the rods) than by the cones. Livingstone found that people rated the Mona Lisa as more cheerful when they were instructed to focus on her eyes than they did when they were asked to look directly at her mouth. As Livingstone put it, "She smiles until you look at her mouth, and then it fades, like a dim star that disappears when you look directly at it." ["Mona Lisa detail face" by Leonardo da Vinci/Louvre Museum/Wikimedia Commons is in the public domain].

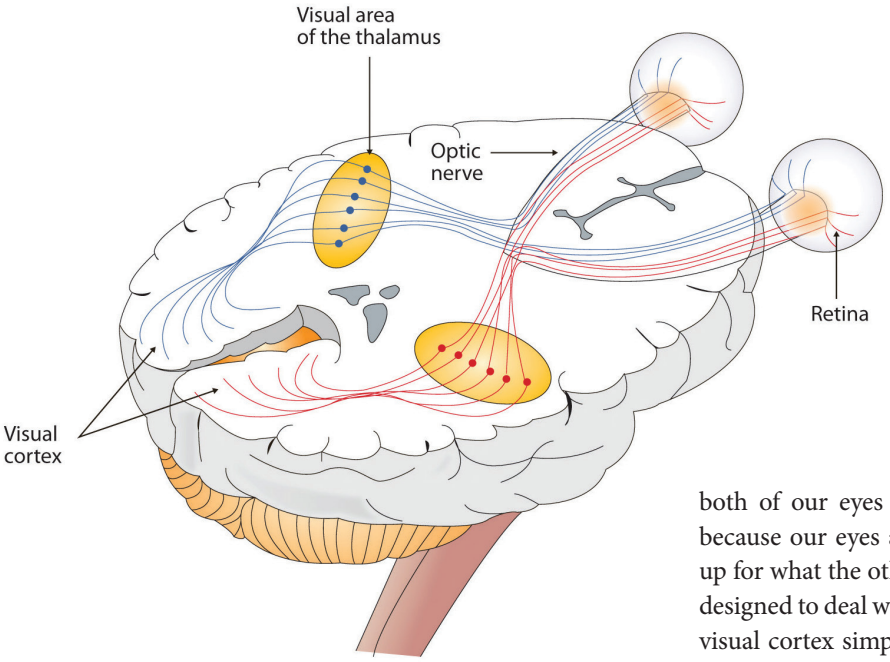


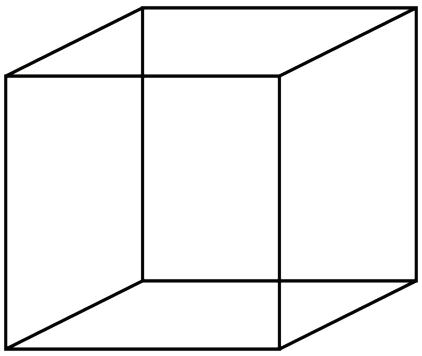
FIGURE 13.5. Pathway of visual images through the thalamus and into the visual cortex. The left and right eyes each send information to both the left and the right brain hemisphere. ["Pathway of Visual Images Through the Thalamus and Into the Visual Cortex" by University of Minnesota Libraries is licensed under CC BY-NC-SA 4.0.]

As you can see in **FIGURE 13.5**, the sensory information received by the retina is relayed through the thalamus to corresponding areas in the visual cortex, which is located in the occipital lobe at the back of the brain. Although the principle of contralateral control might lead you to expect that the left eye would send information to the right brain hemisphere and vice versa, nature is smarter than that. In fact, the left and right eyes each send information to both the left and the right hemisphere, and the visual cortex processes each of the cues separately and in parallel. This is an adaptational advantage to an organism that loses sight in one eye, because even if only one eye is functional, both hemispheres will still receive input from it.

The visual cortex is made up of specialized neurons that turn the sensations they receive from the optic nerve into meaningful images. Because there are no photoreceptor cells at the place where the optic nerve leaves the retina, a hole or *blind spot* in our vision is created (see **FIGURE 13.6**). When both of our eyes are open, we don't experience a problem because our eyes are constantly moving, and one eye makes up for what the other eye misses. But the visual system is also designed to deal with this problem if only one eye is open—the visual cortex simply fills in the small hole in our vision with similar patterns from the surrounding areas, and we never notice the difference. The ability of the visual system to cope with the blind spot is another example of how sensation and perception work together to create meaningful experience.

Perception is created in part through the simultaneous action of thousands of **feature detector neurons**—specialized neurons, located in the visual cortex, that respond to the strength, angles, shapes, edges, and movements of a visual stimulus (Kelsey, 1997; Livingstone & Hubel, 1988). The feature detectors work in parallel, each performing a specialized function. When faced with a red square, for instance, the parallel line feature detectors, the horizontal line feature detectors, and the red color feature detectors all become activated. This activation is then passed on to other parts of the visual cortex where other neurons compare the information supplied by the feature detectors with images stored in memory. Suddenly, in a flash of recognition, the many neurons fire together, creating the single image of the red square that we experience (Rodriguez et al., 1999).

FIGURE 13.6. Blind spot demonstration. You can get an idea of the extent of your blind spot (the place where the optic nerve leaves the retina) by trying this demonstration. Close your left eye and stare with your right eye at the cross in the diagram. You should be able to see the elephant image to the right (don't look at it, just notice that it is there). If you can't see the elephant, move closer or farther away until you can. Now slowly move so that you are closer to the image while you keep looking at the cross. At one distance (probably a foot or so), the elephant will completely disappear from view because its image has fallen on the blind spot. ["Blind Spot Demonstration" by University of Minnesota Libraries is licensed under CC BY-NC-SA 4.0.]



The Necker cube is an example of how the visual system creates perceptions out of sensations. We do not see a series of lines, but rather a cube. Which cube we see varies depending on the momentary outcome of perceptual processes in the visual cortex. ["Necker cube" by BenFrantzDale/Wikimedia Commons is licensed under CC BY-SA 3.0.]

Some feature detectors are tuned to selectively respond to particularly important objects, for instance, faces, smiles, and other parts of the body (Downing et al., 2001; Haxby et al., 2001). When researchers disrupted face recognition areas of the cortex using the magnetic pulses of transcranial magnetic stimulation (TMS), people were temporarily unable to recognize faces, and yet they were still able to recognize houses (McKone et al., 2007; Pitcher et al., 2007).

PERCEIVING COLOR

It has been estimated that the human visual system can detect and discriminate among 7 million color variations (Geldard, 1972), but these variations are all created by the combinations of the three primary colors: red, green, and blue. The shade of a color, known as **hue**, is conveyed by the wavelength of the light that enters the eye (we see shorter wavelengths as more blue and longer wavelengths as more red), and we detect brightness from the *intensity* or height of the wave (bigger or more intense waves are perceived as brighter) (**FIGURE 13.7**).

In his important research on color vision, Hermann von Helmholtz (1821–1894) theorized that color is perceived because the cones in the retina come in three types. One type of cone reacts primarily to blue light (short wavelengths), another reacts primarily to green light (medium wavelengths), and a third reacts primarily to red light (long wavelengths). The visual cortex then detects and compares the strength of the signals from each of the three types of cones, creating the experience of color. According to this **Young-Helmholtz trichromatic color theory**, what color we see depends on the mix of the signals from the three types of cones. If the brain is receiving primarily red and blue signals, for instance, it will perceive purple; if it is receiving primarily red and green signals it will perceive yellow; and if it is receiving messages from all three types of cones it will perceive white.

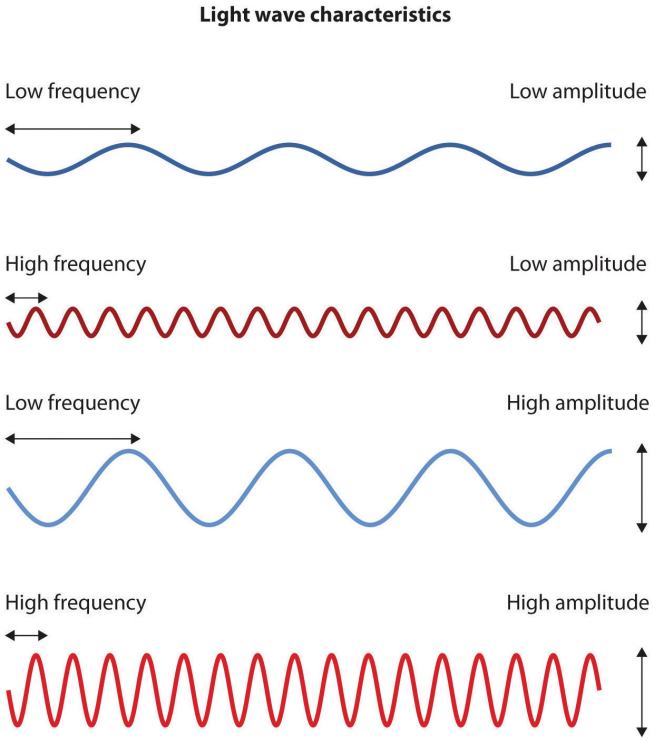


FIGURE 13.7. Low- and high-frequency sine waves and low- and high-intensity sine waves and their corresponding colors. Light waves with shorter frequencies are perceived as more blue than red; light waves with higher intensity are seen as brighter. ["Light wave characteristics" by University of Minnesota is licensed under CC BY-NC-SA 4.0.]

The different functions of the three types of cones are apparent in people who experience **color blindness**—the inability to detect green and/or red colors. About 1 in 50 people, mostly men, lack functioning in the red- or green-sensitive cones, leaving them only able to experience either one or two colors (**FIGURE 13.8**).

The trichromatic color theory cannot explain all of human vision, however. For one, although the color purple

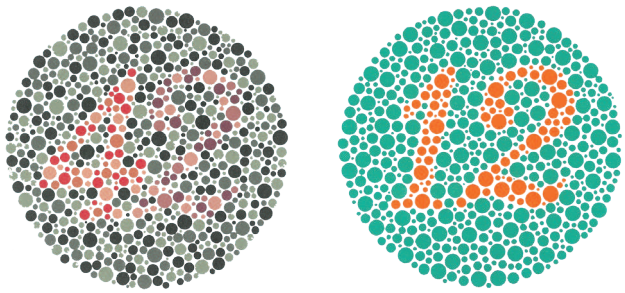


FIGURE 13.8. People with normal color vision can see the number 42 in the first image and the number 12 in the second (they are vague but apparent). However, people who are color blind cannot see the numbers at all. ["Ishihara Plate No. 23"/Wikimedia Commons (left) and "Ishihara Plate No. 1"/Wikimedia Commons (right) are in the public domain.]

FIGURE 13.9. The presence of an afterimage is best explained by the opponent-process theory of color perception. Stare at the flag for 15 to 30 seconds, and then move your gaze to the blank space next to it. Do you see the afterimage? [This work, "Afterimage," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "US flag(inverted)" by Mike Swanson/Wikimedia Commons, which is in the public domain.]

does appear to us as a mixing of red and blue, yellow does not appear to be a mix of red and green. And people with color blindness, who cannot see either green or red, nevertheless can still see yellow. An alternative approach to the Young-Helmholtz theory, known as the **opponent-process color theory**, proposes that we analyze sensory information not in terms of three colors but rather in three sets of "opponent colors": red-green, yellow-blue, and white-black. Evidence for the opponent-process theory comes from the fact that some neurons in the retina and in the visual cortex are excited by one color (e.g., red) but inhibited by another color (e.g., green).

One example of opponent processing occurs in the experience of an afterimage. If you stare at the flag on the left side of **FIGURE 13.9** for about 30 seconds (the longer you look, the better the effect), and then move your eyes to the blank area to the right of it, you will see the afterimage. When we stare at the green stripes, our green receptors habituate and begin to process less strongly, whereas the red receptors remain at full strength. When we switch our gaze, we see primarily the red part of the opponent process. Similar processes create blue after yellow and white after black.

The tricolor and the opponent-process mechanisms work together to produce color vision. When light rays enter the eye, the red, blue, and green cones on the retina respond in different degrees and send different strength signals of red, blue, and green through the optic nerve. The color signals are then processed both by the ganglion cells and by the neurons in the visual cortex (Gegenfurtner & Kiper, 2003).

PERCEIVING FORM

One of the important processes required in vision is the perception of form. German psychologists in the 1930s and 1940s, including Max Wertheimer (1880–1943), Kurt Koffka (1886–1941), and Wolfgang Kohler (1887–1967), argued that we create forms out of their component sensations based on the idea of the **gestalt**, a meaningfully organized whole. The idea of the gestalt is that the "whole is more than the sum of its parts." Some examples of how gestalt principles lead us to see more than what is actually there are summarized in **TABLE 13.1**.

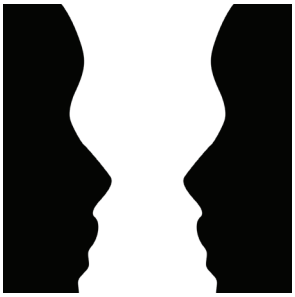
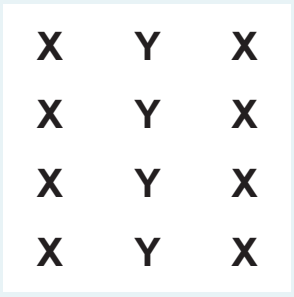
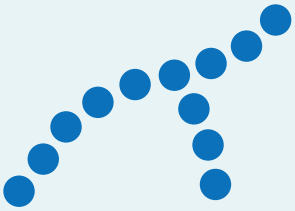
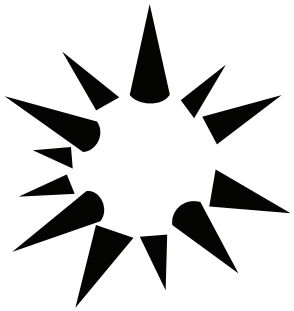
PERCEIVING DEPTH

Depth perception is the ability to perceive three-dimensional space and to accurately judge distance. Without depth perception, we would be unable to drive a car, thread a needle, or simply navigate our way around the supermarket (Howard & Rogers, 2001). Research has found that depth perception is in part based on innate capacities and in part learned through experience (Witherington, 2005).

Psychologists Eleanor Gibson and Richard Walk (1960) tested the ability to perceive depth in 6- to 14-month-old infants by placing them on a **visual cliff**, a mechanism that gives the perception of a dangerous drop-off, in which infants can be safely tested for their perception of depth (**FIGURE 13.10**). The infants were placed on one side of the "cliff," while their mothers called to them from the other side. Gibson and

FIGURE 13.10. A mother urging her child from across the deep side of the visual cliff. Despite a transparent surface covering the cliff, the child hesitates to move forward. ["NIH visual cliff experiment" by U.S. National Institutes of Health/Wikimedia Commons is licensed under CC-BY-SA 4.0. From Gibson and Walk (1960). Copyright 1960 Nature Publishing Group.]

TABLE 13.1. Summary of Gestalt Principles of Form Perception

Principle	Description	Example	Image
Figure and ground	We structure input such that we always see a figure (image) against a ground (background).	At right, you may see a vase or you may see two faces, but in either case, you will organize the image as a figure against a ground.	
Similarity	Stimuli that are similar to each other tend to be grouped together.	You are more likely to see three similar columns among the *XYX* characters at right than you are to see four rows.	
Proximity	We tend to group nearby figures together.	Do you see four or eight images at right? Principles of proximity suggest that you might see only four.	
Continuity	We tend to perceive stimuli in smooth, continuous ways rather than in more discontinuous ways.	At right, most people see a line of dots that moves from the lower left to the upper right, rather than a line that moves from the left and then suddenly turns down. The principle of continuity leads us to see most lines as following the smoothest possible path.	
Closure	We tend to fill in gaps in an incomplete image to create a complete, whole object.	Closure leads us to see a single spherical object at right rather than a set of unrelated cones.	

Walk found that most infants either crawled away from the cliff or remained on the board and cried because they wanted to go to their mothers, but the infants perceived a chasm that they instinctively could not cross. Further research has found that even very young children who cannot yet crawl are fearful of heights (Campos et al., 1970). On the other hand, studies have also found that infants improve their hand-eye coordination as they learn to better grasp objects and as they gain more experience in crawling, indicating that depth perception is also learned (Adolph, 2000).

Depth perception is the result of our use of **depth cues**, messages from our bodies and the external environment that supply us with information about space and distance. **Binocular depth cues** are depth cues that are created by retinal image disparity—that is, the space between our eyes—and thus require the coordination of both eyes. One outcome of retinal disparity is that the images projected on each eye are slightly different from each other. The visual cortex automatically merges the two images into one, enabling us to perceive depth. Three-dimensional movies make use of retinal

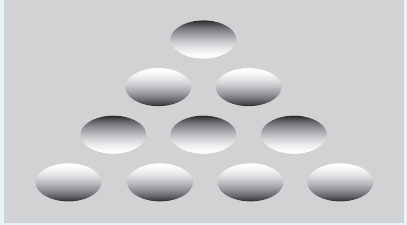
disparity by using 3-D glasses that the viewer wears to create a different image on each eye. The perceptual system quickly, easily, and unconsciously turns the disparity into 3-D.

An important binocular depth cue is **convergence**, the inward turning of our eyes that is required to focus on objects that are less than about 50 feet away from us. The visual cortex uses the size of the convergence angle between the eyes to judge the object's distance. You will be able to feel your eyes converging if you slowly bring a finger closer to your nose while continuing to focus on it. When you close one eye, you no longer feel the tension—convergence is a binocular depth cue that requires both eyes to work.

The visual system also uses *accommodation* to help determine depth. As the lens changes its curvature to focus on distant or close objects, information relayed from the muscles attached to the lens helps us determine an object's distance. Accommodation is only effective at short viewing distances, however, so while it comes in handy when threading a needle or tying shoelaces, it is far less effective when driving or playing sports.

Although the best cues to depth occur when both eyes work together, we are able to see depth even with one eye closed. **Monocular depth cues** are depth cues that help us perceive depth using only one eye (Sekuler & Blake, 2006). Some of the most important are summarized in **TABLE 4.2**.

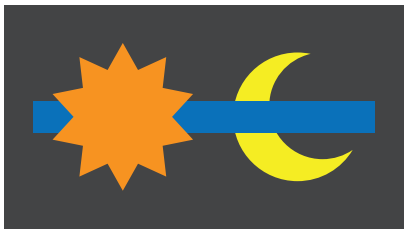
TABLE 4.2. Monocular Depth Cues That Help Us Judge Depth at a Distance

Name	Description	Example	Image
Position	We tend to see objects higher up in our field of vision as farther away.	In the image, the fence posts at left appear farther away not only because they become smaller but also because they appear higher up in the picture.	
Relative size	Assuming that the objects in a scene are the same size, smaller objects are perceived as farther away.	At right, the cars in the distance appear smaller than those nearer to us.	
Linear perspective	Parallel lines appear to converge at a distance.	We know that the tracks at right are parallel. When they appear closer together, we determine they are farther away.	
Light and shadow	The eye receives more reflected light from objects that are closer to us. Normally, light comes from above, so darker images are in shadow.	We see the ovals at right as extended and indented according to their shadowing. If we invert the picture, the images will reverse.	

Images: "New Zealand in autumn" by Hazel Owen/Flickr is licensed under CC BY-NC-ND 2.0; "cars" by Ben Dalton is licensed under CC BY-SA 2.0; "Converge" by Steve Webel is licensed under CC BY-NC-ND 2.0; "Light and Shadow" by Judy Schmitt is licensed under CC BY-NC-SA 4.0.

Table continues on following page.

TABLE 4.2. Monocular Depth Cues That Help Us Judge Depth at a Distance *(continued)*

Name	Description	Example	Image
Interposition	When one object overlaps another object, we view it as closer.	At right, because the orange star covers the blue bar, it is seen as closer than the yellow moon.	
Aerial perspective	Objects that appear hazy, or that are covered with smog or dust, appear farther away.	The artist who painted the picture on the right used aerial perspective to make the distant hills more hazy and thus appear farther away.	

Images: "Interposition" by Judy Schmitt is licensed under CC BY-NC-SA 4.0; "Frans Koppelaar – Landscape near Bologna"/Wikimedia Commons is licensed under CC BY-SA 2.5.

PERCEIVING MOTION

Many animals, including human beings, have very sophisticated perceptual skills that allow them to coordinate their own motion with the motion of moving objects in order to create a collision with that object. Bats and birds use this mechanism to catch up with prey, dogs use it to catch a Frisbee, and humans use it to catch a moving football. The brain detects motion partly from the changing size of an image on the retina (objects that look bigger are usually closer to us) and in part from the relative brightness of objects.

We also experience motion when objects near each other change their appearance. The **beta effect** refers to the perception of motion that occurs when different images are presented next to each other in succession (see the Beta Effect and Phi Phenomenon note). The visual cortex fills in the missing part of the motion and we see the object moving. The beta effect is used in movies to create the experience of motion. A related effect is the **phi phenomenon**, in which we perceive a sensation of motion caused by the appearance and disappearance of objects that are near each other. The phi phenomenon looks like a moving zone or cloud of background color surrounding the flashing objects. The beta effect and the phi phenomenon are other examples of the importance of the gestalt—our tendency to "see more than the sum of the parts."

BETA EFFECT AND PHI PHENOMENON

In the beta effect, our eyes detect motion from a series of still images, each with the object in a different place. This is the fundamental mechanism of motion pictures (movies).

In the phi phenomenon, the perception of motion is based on the momentary hiding of an image.

KEY TAKEAWAYS

- Vision is the process of detecting the electromagnetic energy that surrounds us. Only a small fraction of the electromagnetic spectrum is visible to humans.
- The visual receptor cells on the retina detect shape, color, motion, and depth.
- Light enters the eye through the transparent cornea and passes through the pupil at the center of the iris. The lens adjusts to focus the light on the retina, where it appears upside down and backward. Receptor cells on the retina are excited or inhibited by the light and send information to the visual cortex through the optic nerve.
- The retina has two types of photoreceptor cells: rods, which detect brightness and respond to black and white, and cones, which respond to red, green, and blue. Color blindness occurs when people lack function in the red- or green-sensitive cones.
- Feature detector neurons in the visual cortex help us recognize objects, and some neurons respond selectively to faces and other body parts.

- The Young-Helmholtz trichromatic color theory proposes that color perception is the result of the signals sent by the three types of cones, whereas the opponent-process color theory proposes that we perceive color as three sets of opponent colors: red-green, yellow-blue, and white-black.
- The ability to perceive depth occurs through the result of binocular and monocular depth cues.
- Motion is perceived as a function of the size and brightness of objects. The beta effect and the phi phenomenon are examples of perceived motion.

EXERCISES AND CRITICAL THINKING

1. Consider some ways that the processes of visual perception help you engage in an everyday activity, such as driving a car or riding a bicycle.
2. Imagine for a moment what your life would be like if you couldn't see. Do you think you would be able to compensate for your loss of sight by using other senses?

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READING 14

Accuracy and Inaccuracy in Perception

SOURCE

University of Minnesota. (2015). *Introduction to psychology.* University of Minnesota Libraries Publishing.
https://open.lib.umn.edu/intropsyc/

LEARNING OBJECTIVES

- Describe how sensation and perception work together through sensory interaction, selective attention, sensory adaptation, and perceptual constancy.
- Give examples of how our expectations may influence our perception, resulting in illusions and potentially inaccurate judgments.

KEY TERMS

illusions
perceptual constancy
selective attention
sensory adaptation
sensory interaction

The eyes, ears, nose, tongue, and skin sense the world around us and, in some cases, perform preliminary information processing on the incoming data. But by and large, we do not experience sensation—we experience the outcome of perception—the total package that the brain puts together from the pieces it receives through our senses and that the brain creates for us to experience. When we look out the window at a view of the countryside, or when we look at the face of a good friend, we don't just see a jumble of colors and shapes—we see, instead, an image of a countryside or an image of a friend (Goodale & Milner, 2006).

HOW THE PERCEPTUAL SYSTEM INTERPRETS THE ENVIRONMENT

This meaning-making involves the automatic operation of a variety of essential perceptual processes. One of these is **sensory interaction**—*the working together of different senses to create experience*. Sensory interaction is involved when taste, smell, and texture combine to create the flavor we experience in food. It is also involved when we enjoy a movie because of the way the images and the music work together.

Although you might think that we understand speech only through our sense of hearing, it turns out that the visual aspect of speech is also important. One example of sensory interaction is shown in the *McGurk effect*—an error in perception that occurs when we misperceive sounds because the audio and visual parts of the speech are mismatched. You can witness the effect yourself by viewing the following video clip.

THE MCGURK EFFECT

Watch this brief video about an auditory illusion known as the McGurk effect.

Other examples of sensory interaction include the experience of nausea that can occur when the sensory information being received from the eyes and the body does not match information from the vestibular system (Flanagan et al., 2004) and *synesthesia*—an experience in which one sensation (e.g., hearing a sound) creates experiences in another (e.g., vision). Most people do not experience synesthesia, but those who do link their perceptions in unusual ways, for instance, by experiencing color when they taste a particular food or by hearing sounds when they see certain objects (Ramachandran et al., 2005).

Another important perceptual process is **selective attention**—the ability to focus on some sensory inputs while tuning out others. View the following video clip and count the number of times the people playing with the ball pass it to each other. You may find that, like many other people who view it for the first time, you miss something important because you selectively attend to only one aspect of the video (Simons & Chabris, 1999).

SELECTIVE ATTENTION

Watch this video and carefully count how many times the people in white pass the ball to each other.

Selective attention also allows us to focus on a single talker at a party while ignoring other conversations that are occurring around us (Broadbent, 1958; Cherry, 1953). Without this automatic selective attention, we'd be unable to focus on the single conversation we want to hear. But selective attention is not complete; we also, at the same time, monitor what's happening in the channels we are not focusing on. Perhaps you have had the experience of being at a party and talking to someone in one part of the room, when suddenly

you hear your name being mentioned by someone in another part of the room. This *cocktail party phenomenon* shows us that although selective attention is limiting what we process, we are nevertheless, at the same time, doing a lot of unconscious monitoring of the world around us—you didn't know you were attending to the background sounds of the party, but evidently you were.

A second fundamental process of perception is **sensory adaptation**—a decreased sensitivity to a stimulus after prolonged and constant exposure. When you step into a swimming pool, the water initially feels cold, but after a while you stop noticing it. After prolonged exposure to the same stimulus, our sensitivity toward it diminishes and we no longer perceive it. The ability to adapt to the things that don't change around us is essential to our survival, as it leaves our sensory receptors free to detect the important and informative changes in our environment and to respond accordingly. We ignore the sounds that our car makes every day, which leaves us free to pay attention to the sounds that are different from normal, and thus likely to need our attention. Our sensory receptors are alert to novelty and are fatigued after constant exposure to the same stimulus.

If sensory adaptation occurs with all senses, why doesn't an image fade away after we stare at it for a period of time? The answer is that, although we are not aware of it, our eyes are constantly flitting from one angle to the next, making thousands of tiny movements (called *saccades*) every minute. This constant eye movement guarantees that the image we are viewing always falls on fresh receptor cells. What would happen if we could stop the movement of our eyes? Psychologists have devised a way of testing the sensory adaptation of the eye by attaching an instrument that ensures a constant image is maintained on the eye's inner surface. Participants are fitted with a contact lens that has a miniature slide projector attached to it. Because the projector follows the exact movements of the eye, the same image is always projected, stimulating the same spot, on the retina. Within a few seconds, interesting things begin to happen. The image will begin to vanish, then reappear, only to disappear again, either in pieces or as a whole. Even the eye experiences sensory adaptation (Yarbus, 1967).

One of the major problems in perception is to ensure that we always perceive the same object in the same way, despite the fact that the sensations that it creates on our receptors changes dramatically. The ability to perceive a stimulus as constant despite changes in sensation is known as **perceptual constancy**. Consider an image of a door as it swings. When it is closed, we see it as rectangular, but when it is open, we see only its edge and it appears as a line. But we never perceive the door as changing shape as it swings—perceptual mechanisms take care of the problem for us by allowing us to see a constant shape.

The visual system also corrects for color constancy. Imagine that you are wearing blue jeans and a bright white t-shirt. When you are outdoors, both colors will be at their brightest, but you will still perceive the white t-shirt as bright and the blue jeans as darker. When you go indoors, the light shining on the clothes will be significantly dimmer, but you will still perceive the t-shirt as bright. This is because we put colors in context and see that, compared to its surroundings, the white t-shirt reflects the most light (McCann, 1992). In the same way, a green leaf on a cloudy day may reflect the same wavelength of light as a brown tree branch does on a sunny day. Nevertheless, we still perceive the leaf as green and the branch as brown.

ILLUSIONS

Although our perception is very accurate, it is not perfect. **Illusions** occur when the perceptual processes that normally help us correctly perceive the world around us are fooled by a particular situation so that we see something that does not exist or that is incorrect. **FIGURE 14.1** presents two situations

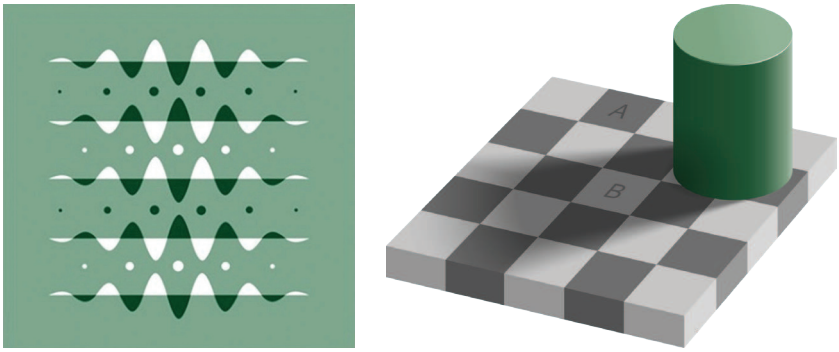

FIGURE 14.1. Optical illusions as a result of brightness constancy (left) and color constancy (right). Look carefully at the snakelike pattern on the left. Are the green strips really brighter than the background? Cover the white curves and you'll see they are not. Square A in the right-hand image looks very different than square B, even though they are exactly the same. ["Brightness Constancy" (left) by University of Minnesota is licensed under CC BY-NC-SA 4.0; "Checker shadow illusion" (right) by Edward H. Adelson/Wikimedia Commons is licensed under CC BY-SA 4.0.]

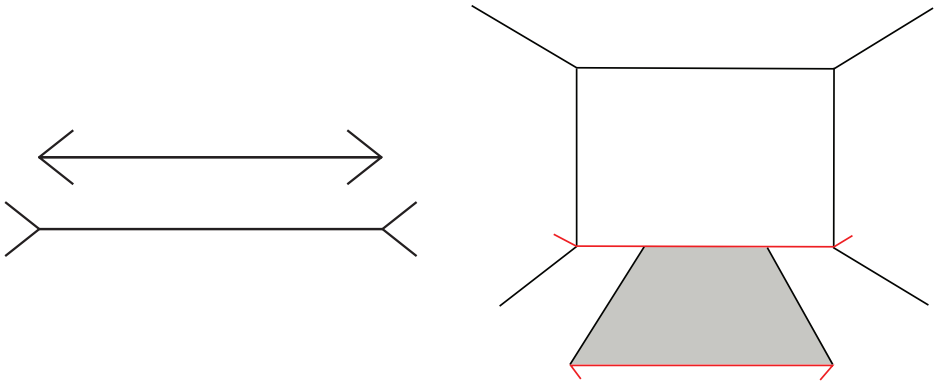

FIGURE 14.2. The Mueller-Lyre illusion makes the line segment at the top of the left picture appear shorter than the one at the bottom. The illusion is caused, in part, by the monocular distance cue of depth—the bottom line looks like an edge that is normally farther away from us, whereas the top one looks like an edge that is normally closer, as illustrated in the picture on the right. ["Müller-Lyer Lines" (left) by Judy Schmitt is in the public domain under CC0 1.0; "Mueller lyer" (right) by António Miguel de Campos/Wikimedia Commons is in the public domain.]

in which our normally accurate perceptions of visual constancy have been fooled.

Another well-known illusion is the *Mueller-Lyer illusion* (see **FIGURE 14.2**). The line segment in the bottom arrow looks longer to us than the one on the top, even though they are both actually the same length. It is likely that the illusion is, in part, the result of the failure of monocular depth cues—the bottom line looks like an edge that is normally farther away from us, whereas the top one looks like an edge that is normally closer.

The *moon illusion* refers to the fact that the moon is perceived to be about 50% larger when it is near the horizon than when it is seen overhead, despite the fact that both moons are the same size and cast the same size retinal image. The monocular depth cues of position and aerial perspective create the illusion that things that are lower and more hazy are farther away. The skyline of the horizon (trees, clouds, outlines of buildings) also gives a cue that the moon is far away, compared to a moon at its zenith. If we look at a horizon moon through a tube of rolled up paper, taking away the surrounding horizon cues, the moon will immediately appear smaller.

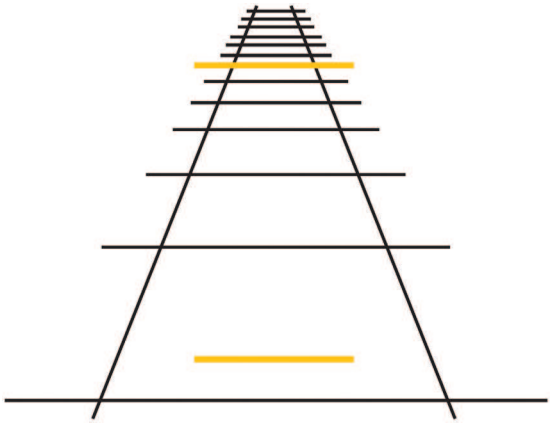

FIGURE 14.3. The Ponzo illusion is caused by a failure of the monocular depth cue of linear perspective: Both bars are the same size, even though the top one looks larger. ["Ponzo Illusion" by University of Minnesota is licensed under CC BY-NC-SA 4.0.]

The *Ponzo illusion* operates on the same principle. As you can see in **FIGURE 14.3**, the top yellow bar seems longer than the bottom one, but if you measure them you'll see that they are exactly the same length. The monocular depth cue of linear perspective leads us to believe that, given two similar objects, the distant one can only cast the same size retinal image as the closer object if it is larger. The topmost bar therefore appears longer.

Illusions demonstrate that our perception of the world around us may be influenced by our prior knowledge. But the fact that some illusions exist in some cases does not mean that the perceptual system is generally inaccurate—in fact, humans normally become so closely in touch with their environment that the physical body and the particular environment we sense and perceive becomes *embodied*—that is, built into and linked with—our cognition, such that the worlds around us become part of our brain (Calvo & Gomila, 2008). The close relationship between people and their environments means that, although illusions can be created in the lab and under some unique situations, they may be less common with active observers in the real world (Runeson, 1988).

THE IMPORTANT ROLE OF EXPECTATIONS IN PERCEPTION

Our emotions, mind-set, expectations, and the contexts in which our sensations occur all have a profound influence on perception. People who are warned that they are about to taste

PSYCHOLOGY IN EVERYDAY LIFE

How Understanding Sensation and Perception Can Save Lives

Human factors is the field of psychology that uses psychological knowledge, including the principles of sensation and perception, to improve the development of technology. Human factors has worked on a variety of projects, ranging from nuclear reactor control centers and airplane cockpits to cell phones and websites (Proctor & Van Zandt, 2008). For instance, modern televisions and computer monitors were developed on the basis of the trichromatic color theory, using three color elements placed close enough together so that the colors are blended by the eye. Knowledge of the visual system also helped engineers create new kinds of displays, such as those used on notebook computers and music players, and better understand how using cell phones while driving may contribute to automobile accidents (Lee & Strayer, 2004).

Human factors also has made substantial contributions to airline safety. About two thirds of accidents on commercial airplane flights are caused by human error (Nickerson, 1998). During takeoff, travel, and landing, the pilot simultaneously communicates with ground control, maneuvers the plane, scans the horizon for other aircraft, and operates controls. The need for a usable interface that works easily and naturally with the pilot's visual perception is essential.

Psychologist Conrad Kraft (1978) hypothesized that as planes land, with no other distance cues visible, pilots may be subjected to a type of moon illusion, in which the city lights beyond the runway appear much larger on the retina than they really are, deceiving the pilot into landing too early. Kraft's findings caused airlines to institute new flight safety measures, where copilots must call out the altitude progressively during the descent, which has probably decreased the number of landing accidents.

FIGURE 14.4 presents the design of an airplane instrument panel before and after it was redesigned by human factors psychologists. On the left is the initial design in which the controls were crowded and cluttered, in no logical sequence, each control performing one task. The controls were more or less the same in color, and the gauges were not easy to read. The redesigned digital cockpit shows a marked improvement in usability. More of the controls are color-coded and multifunctional so that there is less clutter on the dashboard. Screens make use of LCD and 3-D graphics. Text sizes are changeable—increasing readability—and many of the functions have become automated, freeing up the pilot's concentration for more important activities.

One important aspect of the redesign was based on the principles of sensory adaptation. Displays that are easy to see in darker conditions quickly become unreadable when the sun shines directly on them. It takes the pilot a relatively long time to adapt to the suddenly much brighter display. Furthermore, perceptual contrast is important. The display cannot be so bright at night that the pilot is unable to see targets in the sky or on the land. Human factors psychologists used these principles to determine the appropriate stimulus intensity needed on these displays so that pilots would be able to read them accurately and quickly under a wide range of conditions. The psychologists accomplished this by developing an automatic control mechanism that senses the ambient light visible through the front cockpit windows and that detects the light falling on the display surface, and then automatically adjusts the intensity of the display for the pilot (Silverstein & Merrifield, 1985; Silverstein et al., 1990). ■

FIGURE 14.4. Airplane cockpits. Initial design of the airplane cockpit (left); the digital design of the airplane cockpit (right), which has taken human factors into account. ["cockpit" by University of Saskatchewan is licensed under CC BY-NC-SA 4.0.]

something bad rate what they do taste more negatively than people who are told that the taste won't be so bad (Nitschke et al., 2006), and people perceive a child and adult pair as looking more alike when they are told that they are parent and child (Bressan & Dal Martello, 2002). Similarly, participants who see images of the same baby rate it as stronger and bigger when they are told it is a boy as opposed to when they are told it is a girl (Stern & Karraker, 1989), and research participants who learn that a child is from a lower-class background perceive the child's scores on an intelligence test as lower than people who see the same test taken by a child they are told is from an upper-class background (Darley & Gross, 1983). Plassmann et al. (2008) found that wines were rated more positively and caused greater brain activity in brain areas associated with pleasure when they were said to cost more than when they were said to cost less. And even experts can be fooled: Professional referees tended to assign more penalty cards to soccer teams for videotaped fouls when they were told that the team had a history of aggressive behavior than when they had no such expectation (Jones et al., 2002).

Our perceptions are also influenced by our desires and motivations. When we are hungry, food-related words tend to grab our attention more than non-food-related words (Mogg et al., 1998); we perceive objects we can reach as bigger than those we cannot reach (Witt & Proffitt, 2005); and people who favor a political candidate's policies view the candidate's skin color more positively than do those who oppose the candidate's policies (Caruso et al., 2009). Even our culture influences perception. Chua et al. (2005) showed American and Asian graduate students different images, such as an airplane, an animal, or a train, against complex backgrounds. They found that (consistent with their overall individualistic orientation) the American students tended to focus more on the foreground image, while Asian students (consistent with their interdependent orientation) paid more attention to the image's context. Furthermore, Asian American students focused more or less on the context depending on whether their Asian or their American identity had been activated.

KEY TAKEAWAYS

- Sensory interaction occurs when different senses work together, for instance, when taste, smell, and touch together produce the flavor of food.
- Selective attention allows us to focus on some sensory experiences while tuning out others.
- Sensory adaptation occurs when we become less sensitive to some aspects of our environment, freeing us to focus on more important changes.
- Perceptual constancy allows us to perceive an object as the same, despite changes in sensation.
- Cognitive illusions are examples of how our expectations can influence our perceptions.
- Our emotions, motivations, desires, and even our culture can influence our perceptions.

EXERCISE

1. Consider some cases where your expectations about what you think you might be going to experience have influenced your perceptions of what you actually experienced.

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READING 15

The Healthy Life

Emily Hooker and Sarah Pressman

SOURCE

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LEARNING OBJECTIVES

- Describe basic terminology used in the field of health psychology.
- Explain theoretical models of health, as well as the role of psychological stress in the development of disease.
- Describe psychological factors that contribute to resilience and improved health.
- Defend the relevance and importance of psychology to the field of medicine.

KEY TERMS

adherence
behavioral medicine
biofeedback
Biomedical Model of Health
Biopsychosocial Model of Health
chronic disease
control
daily hassles
emotion-focused coping
general adaptation syndrome
health
health behaviors
hostility
mind–body connection
problem-focused coping
psychoneuroimmunology
psychosomatic medicine
resilience
self-efficacy
social integration
social support
stress
stressors
Type A behavior
Type B behavior

Our emotions, thoughts, and behaviors play an important role in our health. Not only do they influence our day-to-day health practices, but they can also influence how our body functions. This module provides an overview of health psychology, which is a field devoted to understanding the connections between psychology and health. Discussed here are examples of topics a health psychologist might study, including stress, psychosocial factors related to health and disease, how to use psychology to improve health, and the role of psychology in medicine.

WHAT IS HEALTH PSYCHOLOGY?

Today, we face more **chronic disease** than ever before because we are living longer lives while also frequently behaving in unhealthy ways. One example of a chronic disease is coronary heart disease (CHD): It is the number one cause of death worldwide (World Health Organization, 2017). CHD develops slowly over time and typically appears midlife, but related heart problems can persist for years after the original diagnosis or cardiovascular event. In managing illnesses that persist over time (other examples might include cancer, diabetes, and long-term disability), many psychological factors will determine the progression of the ailment. For example, do patients seek help when appropriate? Do they follow doctor recommendations? Do they develop negative psychological symptoms due to lasting illness (e.g., depression)? Also important is that psychological factors can play a significant role in *who* develops these diseases, the prognosis, and the nature of the symptoms related to the illness. Health psychology is a relatively new, interdisciplinary field of study that focuses on these very issues, or more specifically, the role of psychology in maintaining health, as well as preventing and treating illness.

Consideration of how psychological and social factors influence health is especially important today because many of the leading causes of illness in developed countries are often attributed to psychological and behavioral factors. In the case of CHD, discussed above, psychosocial factors, such as excessive stress, smoking, unhealthy eating habits, and some personality traits can also lead to increased risk of disease and worse health outcomes. That being said, many of these factors can be adjusted using psychological techniques. For example,

Health psychologists help people adapt behaviors to avoid disease, reduce stress, and improve overall health. ["ALC Health Expo 5K Run" by Doug LaFon/Adelphi Lab Center/Flickr is licensed under CC BY 2.0.]

clinical health psychologists can improve health practices like poor dietary choices and smoking, they can teach important stress reduction techniques, and they can help treat psychological disorders tied to poor health. Health psychology considers how the choices we make, the behaviors we engage in, and even the emotions we feel can play an important role in our overall health (Cohen & Herbert, 1996; Taylor, 2012).

Health psychology relies on the **Biopsychosocial Model of Health**. This model posits that biology, psychology, and social factors are just as important in the development of disease as biological causes (e.g., germs, viruses), which is consistent with the World Health Organization (1946) definition of **health**. This model replaces the older **Biomedical Model of Health**, which primarily considers the physical, or pathogenic, factors contributing to illness. Thanks to advances in medical technology, there is a growing understanding of the physiology underlying the **mind–body connection** and, in particular, the role that different feelings can have on our body's function. Health psychology researchers working in the fields of **psychosomatic medicine** and **psychoneuroimmunology**, for example, are interested in understanding how psychological factors can "get under the skin" and influence our physiology in order to better understand how factors like stress can make us sick.

STRESS AND HEALTH

You probably know exactly what it's like to feel stress, but what you may not know is that it can objectively influence your health. Answers to questions like "How stressed do you feel?" or "How overwhelmed do you feel?" can predict your likelihood of developing both minor illnesses and serious problems like future heart attack (Cohen et al., 2007). To understand how health psychologists study these types of associations, we will describe one famous example of a stress and health study. Imagine that you are a research subject for a moment. After you check into a hotel room as part of the study, the researchers ask you to report your general levels of stress. Not too surprising; however, what happens next is that you receive droplets of *cold virus* into your nose! The researchers intentionally try to make you sick by exposing you to an infectious illness. After they expose you to the virus, the researchers will then evaluate you for several days by asking you questions about your symptoms, monitoring how much mucus you are producing by weighing your used tissues, and taking body fluid samples—all to see if you are objectively ill with a cold. Now, the interesting thing is that not everyone who has drops of cold virus put in their nose develops the illness. Studies like this one find that people who are less stressed and those who are more positive at the beginning of the study are at a decreased risk of developing a cold (Cohen et al., 1991, 2006) (see **FIGURE 15.1** for an example).

Importantly, it is not just major life **stressors** (e.g., a family death, a natural disaster) that increase the likelihood of getting sick. Even small **daily hassles** like getting stuck in traffic or fighting with your girlfriend can raise your blood pressure, alter your stress hormones, and even suppress your immune system function (DeLongis et al., 1988; Twisk et al., 1999).

It is clear that stress plays a major role in our mental and physical health, but what exactly is it? The term **stress** was originally derived from the field of mechanics where it is used to describe materials under pressure. The word was first used in a *psychological* manner by researcher Hans Selye. He was

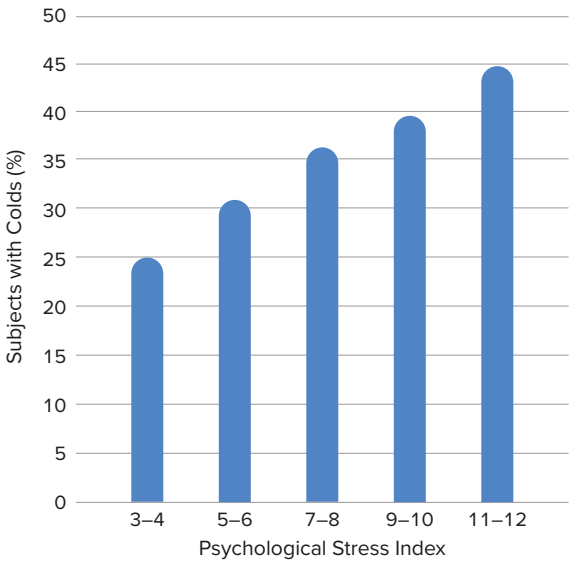


FIGURE 15.1. Positive correlation between test subjects' stress levels and their tendency to develop a cold. ["Stress and Cold Development" by Judy Schmitt is licensed under CC BY-NC-SA 4.0. Adapted from Cohen et al. (1991).]

examining the effect of an ovarian hormone that he thought caused sickness in a sample of rats. Surprisingly, he noticed that almost any injected hormone produced this same sickness. He smartly realized that it was not the hormone under investigation that was causing these problems, but instead, the aversive experience of being handled and injected by researchers that led to high physiological arousal and, eventually, to health problems like ulcers. Selye (1946) coined the term stressor to label a stimulus that had this effect on the body and developed a model of the stress response called the **general adaptation syndrome**. Since then, psychologists have studied stress in a myriad of ways, including stress as negative events (e.g., natural disasters or major life changes like dropping out of school), as chronically difficult situations (e.g., taking care of a loved one with Alzheimer's), as short-term hassles, as a biological fight-or-flight response, and even as clinical illness like post-traumatic stress disorder (PTSD). It continues to be one of the most important and well-studied psychological correlates of illness, because excessive stress causes potentially damaging wear and tear on the body and can influence almost any imaginable disease process.

PROTECTING OUR HEALTH

An important question that health psychologists ask is, *What keeps us protected from disease and alive longer?* When considering this issue of **resilience** (Rutter, 1985), five factors are often studied in terms of their ability to protect (or sometimes harm) health. They are:

1. Coping
2. Control and Self-Efficacy
3. Social Relationships
4. Dispositions and Emotions
5. Stress Management

Coping Strategies

How individuals cope with the stressors they face can have a significant impact on health. Coping is often classified into two categories: problem-focused coping or emotion-focused coping (Carver et al., 1989). **Problem-focused coping** is thought of as actively addressing the event that is causing stress in an effort to solve the issue at hand. For example, say you have an important exam coming up next week. A problem-focused strategy might be to spend additional time over the weekend studying to make sure you understand all of the material. **Emotion-focused coping**, on the other hand, regulates the emotions that come with stress. In the above examination example, this might mean watching a funny movie to take your mind off the anxiety you are feeling. In the short term, emotion-focused coping might reduce feelings of stress, but problem-focused coping seems to have the greatest impact on mental wellness (Billings & Moos, 1981; Herman-Stabl et al., 1995). That being said, when events are uncontrollable (e.g., the death of a loved one), emotion-focused coping directed at managing your feelings, at first, might be the better strategy. Therefore, it is always important to consider the match of the stressor to the coping strategy when evaluating its plausible benefits.

Control and Self-Efficacy

Another factor tied to better health outcomes and an improved ability to cope with stress is having the belief that you have **control** over a situation. For example, in one study where participants were forced to listen to unpleasant (stressful) noise, those who were led to believe that they had control over the noise performed much better on proofreading tasks afterwards (Glass & Singer, 1972). In other words, even though participants *did not* have actual control over the noise, the control *belief* aided them in completing the task. In similar studies, perceived control benefited immune system functioning (Sieber et al., 1992). Outside of the laboratory, studies have shown that older residents in assisted living facilities, which are notorious for low control, lived *longer* and showed *better* health outcomes when given control over something as simple as watering a plant or choosing when student volunteers came to visit (Rodin & Langer, 1977; Schulz & Hanusa, 1978). In addition, feeling in control of a threatening situation can actually change stress hormone levels (Dickerson & Kemeny, 2004). Believing that you have control over your own behaviors can also have a positive influence on

Feeling a sense of control in one's life is important. Something as simple as having control over the care of a houseplant has been shown to improve health and longevity. ["Sedum rubrotinctum" by JJ Harrison/Wikimedia Commons is licensed under CC BY-SA 2.5.]

important outcomes like smoking cessation, contraception use, and weight management (Wallston & Wallston, 1978). When individuals do not believe they have control, they do not try to change.

Self-efficacy is closely related to control, in that people with high levels of this trait believe they can complete tasks and reach their goals. Just as feeling in control can reduce stress and improve health, higher self-efficacy can reduce stress and negative health behaviors and is associated with better health (O'Leary, 1985).

Social Relationships

Research has shown that the impact of social isolation on our risk for disease and death is similar in magnitude to the risk associated with smoking regularly (Holt-Lunstad et al., 2010; House et al., 1988). In fact, the importance of social relationships for our health is so significant that some scientists believe our body has developed a physiological system that encourages us to seek out our relationships, especially in times of stress (Taylor et al., 2000). **Social integration** is the concept used to describe the number of social roles that you have (Cohen & Wills, 1985), as well as the lack of isolation. For example, you might be a daughter, a basketball team member, a Humane Society volunteer, a coworker, and a student. Maintaining these different roles can improve your health via encouragement from those around you to maintain a healthy lifestyle. Those in your social network might also provide you with **social support** (e.g., when you are under stress). This support might include emotional help (e.g., a hug when you need it), tangible help (e.g., lending you money), or advice. By helping to improve health behaviors and reduce stress, social relationships can have a powerful, protective impact on health and, in some cases, might even help people with serious illnesses stay alive longer (Spiegel et al., 1989).

Dispositions and Emotions: What's Risky and What's Protective?

Negative dispositions and personality traits have been strongly tied to an array of health risks. One of the earliest negative trait-to-health connections was discovered in the 1950s by two cardiologists. They made the interesting discovery that there were common behavioral and psychological patterns among their heart patients that were not present in other patient samples. This pattern included being competitive, impatient, hostile, and time urgent. They labeled it **Type A behavior**. Importantly, it was found to be associated with *double* the risk of heart disease as compared with **Type B behavior** (Friedman & Rosenman, 1959). Since the 1950s, researchers have discovered that it is the **hostility** and competitiveness components of Type A that are especially harmful to heart health (Iribarren et al., 2000; Matthews et al., 1977; Miller et al., 1996). Hostile individuals are quick to get upset, and this angry arousal can damage the arteries of the heart. In addition, given their negative personality style, hostile people often lack a heath-protective supportive social network.

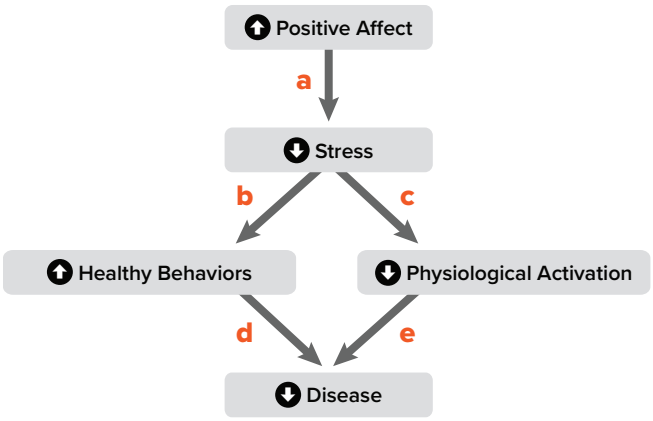


FIGURE 15.2. One possible way that positive affect protects individuals against disease. Positive affect can reduce stress perceptions (a), thereby improving health behaviors (b) and lowering physiological stress responses (c) (e.g., decreased cardiovascular reactivity, lower stress hormones, non-suppressed immune activity). As a result, there is likely to be less incidence of disease (d, e). ["Positive Affect and Disease" by Judy Schmitt is licensed under CC BY-NC-SA 4.0. Adapted from Pressman and Cohen (2005).]

Positive traits and states, on the other hand, are often health protective. For example, characteristics like positive emotions (e.g., feeling happy or excited) have been tied to a wide range of benefits such as increased longevity, a reduced likelihood of developing some illnesses, and better outcomes once you are diagnosed with certain diseases (e.g., heart disease, HIV) (Pressman & Cohen, 2005). Across the world, even in the most poor and underdeveloped nations, positive emotions are consistently tied to better health (Pressman et al., 2013). Positive emotions can also serve as the "antidote" to stress, protecting us against some of its damaging effects (Fredrickson, 2001; Pressman & Cohen, 2005) (see **FIGURE 15.2**). Similarly, looking on the bright side can also improve health. Optimism has been shown to improve coping, reduce stress, and predict better disease outcomes like recovering from a heart attack more rapidly (Kubzansky et al., 2001; Nes & Segerstrom, 2006; Scheier & Carver, 1985; Segerstrom et al., 1998).

Stress Management

About 20% of Americans report having stress, with 18- to 33-year-olds reporting the highest levels (American Psychological Association, 2012). Given that the sources of our stress are often difficult to change (e.g., personal finances, current job), a number of interventions have been designed to help reduce the aversive responses to duress. For example,

relaxation activities and forms of meditation are techniques that allow individuals to reduce their stress via breathing exercises, muscle relaxation, and mental imagery. Physiological arousal from stress can also be reduced via **biofeedback**, a technique in which the individual is shown bodily information that is not normally available to them (e.g., heart rate), and then taught strategies to alter this signal. This type of intervention has even shown promise in reducing heart disease and hypertension risk, as well as other serious conditions (e.g., Moravec, 2008; Patel et al., 1981). But reducing stress does not have to be complicated! For example, exercise is a great stress reduction activity (Salmon, 2001) that has a myriad of health benefits.

THE IMPORTANCE OF GOOD HEALTH PRACTICES

As a student, you probably strive to maintain good grades, to have an active social life, and to stay healthy (e.g., by getting enough sleep), but there is a popular joke about what it's like to be in college: you can only pick two of these things (see **FIGURE 15.3** for an example). The busy life of a college student doesn't always allow you to maintain all three areas of your life, especially during test-taking periods. In one study, researchers found that students taking exams were more stressed and, thus, smoked more, drank more caffeine, had less physical activity, and had worse sleep habits (Oaten & Chang, 2005), all of which could have detrimental effects on their health. Positive health practices are *especially* important in times of stress when your immune system is compromised due to high stress and the elevated frequency of exposure to the illnesses of your fellow students in lecture halls, cafeterias, and dorms.

Psychologists study both **health behaviors** and health habits. The former are behaviors that can improve or harm your health. Some examples include regular exercise, flossing, and wearing sunscreen, versus negative behaviors like drunk driving, pulling all-nighters, or smoking. These behaviors become *habits* when they are firmly established and performed automatically. For example, do you have to think about putting your seatbelt on or do you do it automatically? Habits are often developed early in life thanks to parental encouragement or the influence of our peer group.

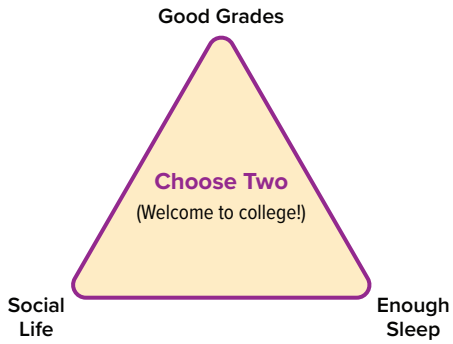
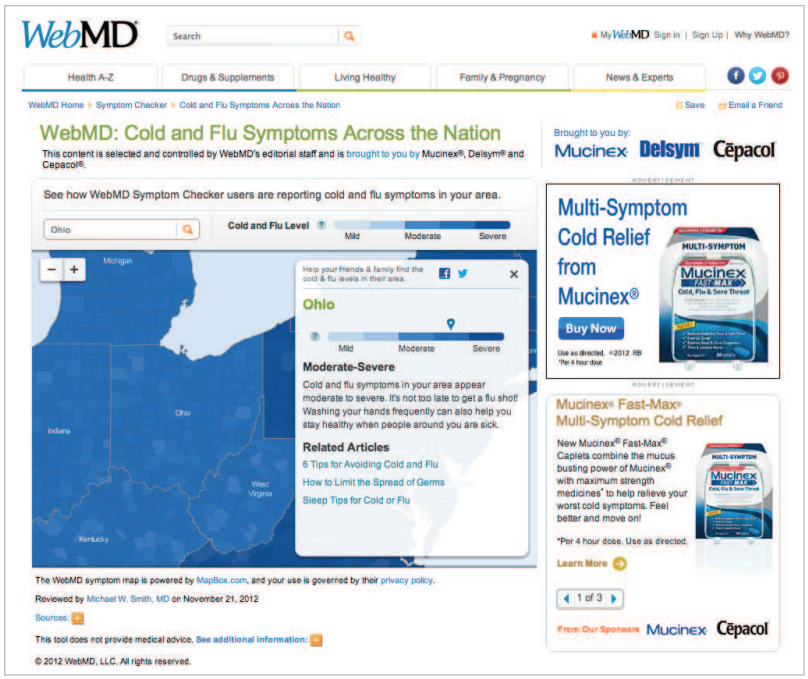


FIGURE 15.3. A popular joke about how difficult it is to stay balanced and healthy during college. ["Choose Two" by Judy Schmitt is licensed under CC BY-NC-SA 4.0.]

While these behaviors sound minor, studies have shown that those who engaged in more of these protective habits (e.g., getting 7–8 hours of sleep regularly, not smoking or drinking excessively, exercising) had fewer illnesses, felt better, and were less likely to die over a 9- to 12-year follow-up period (Belloc & Breslow, 1972; Breslow & Enstrom, 1980). For college students, health behaviors can even influence academic performance. For example, poor sleep quality and quantity are related to weaker learning capacity and academic performance (Curcio et al., 2006). Due to the effects that health behaviors can have, much effort is put forward by psychologists to understand *how* to change unhealthy behaviors, and to understand *why* individuals fail to act in healthy ways. Health promotion involves enabling individuals to improve health by focusing on behaviors that pose a risk for future illness, as well as spreading knowledge on existing risk factors. These might be genetic risks you are born with, or something you developed over time like obesity, which puts you at risk of Type 2 diabetes and heart disease, among other illnesses.

PSYCHOLOGY AND MEDICINE

There are many psychological factors that influence medical treatment outcomes. For example, older individuals (Meara et al., 2004), women (Briscoe, 1987), and those from higher socioeconomic backgrounds (Adamson et al., 2008). are all *more* likely to seek medical care. On the other hand, some individuals who need care might avoid it due to financial obstacles or preconceived notions about medical practitioners or the illness. Thanks to the growing amount of medical information online, many people now use the Internet for health information, and 38% report that this influences their decision to see a doctor (Fox & Jones, 2009). Unfortunately, this is not always a good thing because individuals tend to do a poor job assessing the credibility of health information. For example, college-student participants reading online articles about HIV and syphilis rated a physician's article and a college student's article as *equally* credible if the participants said they were familiar with the health topic (Eastin, 2001). Credibility of health information often means how accurate or trustworthy the information is, and it can be influenced by irrelevant factors, such as the website's design, logos, or the organization's contact information (Freeman & Spyridakis, 2004). Similarly, many people post health questions on unmoderated online forums where *anyone* can respond, which allows for the possibility of inaccurate information being provided for serious medical conditions by unqualified individuals.



While the Internet has increased the amount of medical information available to the public and created greater access, there are real concerns about how people are making decisions about their health based on that information. ["WebMD Publishes Flu Risk Map with MapBox" by Mapbox/Flickr is licensed under CC BY 2.0.]

After individuals decide to seek care, there is also variability in the information they give their medical provider. Poor communication (e.g., due to embarrassment or feeling rushed) can influence the accuracy of the diagnosis and the effectiveness of the prescribed treatment. Similarly, there is variation following a visit to the doctor. While most individuals are tasked with a health recommendation (e.g., buying and using a medication appropriately, losing weight, going to another expert), not everyone *adheres* to medical recommendations (Dunbar-Jacob & Mortimer-Stephens, 2010). For example, many individuals take medications inappropriately (e.g., stopping early, not filling prescriptions) or fail to change their behaviors (e.g., quitting smoking). Unfortunately, getting patients to follow medical orders is not as easy as one would think. For example, in one study, over one third of diabetic patients failed to get proper medical care that would prevent or slow down diabetes-related blindness (Schoenfeld et al., 2001)! Fortunately, as mobile technology improves, physicians now have the ability to monitor **adherence** and work to improve it (e.g., with pill bottles that monitor if they are opened at the right time). Even text messages are useful for improving treatment adherence and outcomes in depression, smoking cessation, and weight loss (Cole-Lewis & Kershaw, 2010).

BEING A HEALTH PSYCHOLOGIST

Training as a clinical health psychologist provides a variety of possible career options. Clinical health psychologists often work on teams of physicians, social workers, allied health professionals, and religious leaders. These teams may be formed in locations like rehabilitation centers, hospitals, primary care offices, emergency care centers, or chronic illness clinics. Work in each of these settings will pose unique challenges in patient care, but the primary responsibility will be the same. Clinical health psychologists will evaluate physical, personal, and environmental factors contributing to illness and preventing improved health. In doing so, they will then help create a treatment strategy that takes into account all dimensions of a person's life and health, which maximizes its potential for success. Those who specialize in health psychology can also conduct research to discover new health predictors and risk factors, or develop interventions to prevent and treat illness. Researchers studying health psychology work in numerous locations, such as universities, public health departments, hospitals, and private organizations. In the related field of **behavioral medicine**, careers focus on the application of this type of research. Occupations in this area might include jobs in occupational therapy, rehabilitation, or preventive medicine. Training as a health psychologist provides a wide skill set applicable in a number of different professional settings and career paths.

THE FUTURE OF HEALTH PSYCHOLOGY

Much of the past medical research literature provides an incomplete picture of human health. "Health care" is often "illness care." That is, it focuses on the management of symptoms and illnesses as they arise. As a result, in many developed countries, we are faced with several health epidemics that are difficult and costly to treat. These include obesity, diabetes, and cardiovascular disease, to name a few. The National Institutes of Health have called for researchers to use the knowledge we have about risk factors to design effective interventions to reduce the prevalence of *preventable* illness. Additionally, there are a growing number of individuals across developed countries with *multiple* chronic illnesses and/or lasting disabilities, especially with older age. Addressing their needs and maintaining their quality of life will require skilled individuals who understand how to properly treat these populations. Health psychologists will be on the forefront of work in these areas.

With this focus on prevention, it is important that health psychologists move beyond studying risk (e.g., depression,

stress, hostility, low socioeconomic status) in isolation, and move toward studying factors that confer resilience and protection from disease. There is, fortunately, a growing interest in studying the positive factors that protect our health (e.g., Diener & Chan, 2011; Pressman & Cohen, 2005; Richman et al., 2005) with evidence strongly indicating that people with higher positivity live longer, suffer fewer illnesses, and generally feel better. Seligman (2008) has even proposed a field of "Positive Health" to specifically study those who exhibit "above average" health—something we do not think about enough. By shifting some of the research focus to identifying and understanding these health-promoting factors, we may capitalize on this information to improve public health.

Innovative interventions to improve health are already in use and continue to be studied. With recent advances in technology, we are starting to see great strides made to improve health with the aid of computational tools. For example, there are hundreds of simple applications (apps) that use email and text messages to send reminders to take medication, as well as mobile apps that allow us to monitor our exercise levels and food intake (in the growing mobile-health, or m-health, field). These m-health applications can be used to raise health awareness, support treatment and compliance, and remotely collect data on a variety of outcomes. Also exciting are devices that allow us to monitor physiology in real time; for example, to better understand the stressful situations that raise blood pressure or heart rate. With advances like these, health psychologists will be able to serve the population better, learn more about health and health behavior, and develop excellent health-improving strategies that could be specifically targeted to certain populations or individuals. These leaps in equipment development, partnered with growing health psychology knowledge and exciting advances in neuroscience and genetic research, will lead health researchers and practitioners into an exciting new time where, hopefully, we will understand more and more about how to keep people healthy.

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READING 16

Substance Use and Abuse

SOURCE

OpenStax. (2019). *Psychology.* OpenStax CNX. https://openstax.org/details/books/psychology

LEARNING OBJECTIVES

- Describe the diagnostic criteria for substance use disorders.
- Identify the neurotransmitter systems affected by various categories of drugs.
- Describe how different categories of drugs effect behavior and experience.

KEY TERMS

codeine
depressant
euphoric high
hallucinogen
methadone
methadone clinics
methamphetamine
physical dependence
psychological dependence
stimulants
tolerance
withdrawal

While we all experience altered states of consciousness in the form of sleep on a regular basis, some people use drugs and other substances that also result in altered states of consciousness. This section will present information relating to the use of various psychoactive drugs and problems associated with such use. This will be followed by brief descriptions of the effects of some of the more well-known drugs commonly used today.

SUBSTANCE USE DISORDERS

The fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-5*) is used by clinicians to diagnose individuals suffering from various psychological disorders. Drug use disorders are addictive disorders, and the criteria for specific substance (drug) use disorders are described in *DSM-5*. A person who has a substance use disorder often uses more of the substance than they originally intended to and continues to use that substance despite experiencing significant adverse consequences. In individuals diagnosed with a substance use disorder, there is a compulsive pattern of drug use that is often associated with both physical and psychological dependence.

Physical dependence involves changes in normal bodily functions—the user will experience withdrawal from the drug upon cessation of use. In contrast, a person who has **psychological dependence** has an emotional, rather than physical, need for the drug and may use the drug to relieve psychological distress. **Tolerance** is linked to physiological dependence, and it occurs when a person requires more and more drug to achieve effects previously experienced at lower doses. Tolerance can cause the user to increase the amount of drug used to a dangerous level—even to the point of overdose and death.

Drug **withdrawal** includes a variety of negative symptoms experienced when drug use is discontinued. These symptoms usually are opposite the effects of the drug. For example, withdrawal from sedative drugs often produces unpleasant arousal and agitation. In addition to withdrawal, many individuals who are diagnosed with substance use disorders will also develop tolerance to these substances. Psychological dependence, or drug craving, is a recent addition to the diagnostic criteria for substance use disorder in *DSM-5*. This is an important factor because we can develop tolerance to and experience withdrawal from any number of drugs that we do not abuse. In other words, physical dependence in and of itself is of limited utility in determining whether or not someone has a substance use disorder.

DRUG CATEGORIES

The effects of all psychoactive drugs occur through their interactions with our endogenous neurotransmitter systems. Many of these drugs, and their relationships, are shown in FIGURE 16.1. As you have learned, drugs can act as agonists or antagonists of a given neurotransmitter system. An agonist facilitates the activity of a neurotransmitter system, and antagonists impede neurotransmitter activity.

Alcohol and Other Depressants

Ethanol, which we commonly refer to as alcohol, is in a class of psychoactive drugs known as depressants (FIGURE 16.2). A **depressant** is a drug that tends to suppress central nervous system activity. Other depressants include barbiturates and

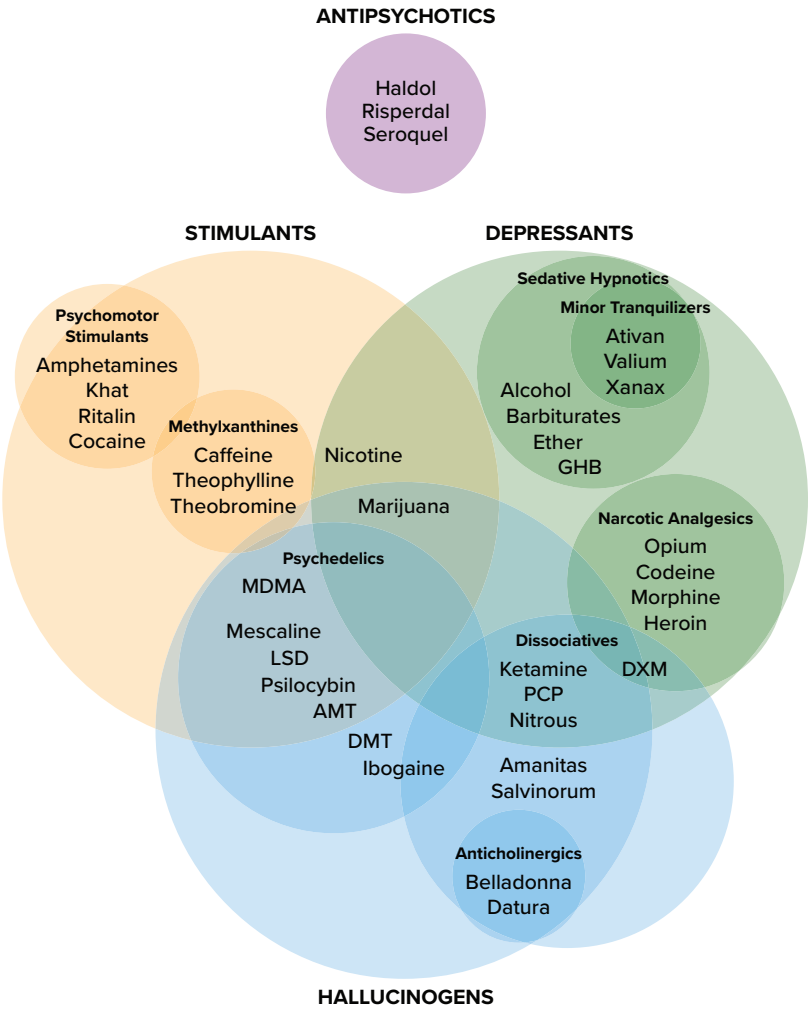

FIGURE 16.1. Various drug categories and the overlap among them. [This work, "Overlapping Drug Categories," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Drug Chart version 1.0" by Derek Snider/Wikimedia Commons, which is licensed under CC BY 1.0.]

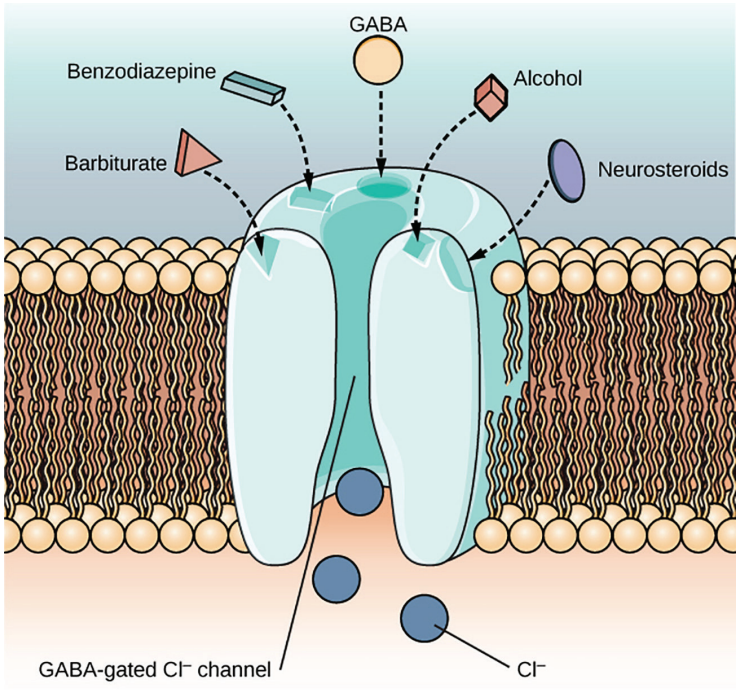

FIGURE 16.2. The GABA-gated chloride (Cl^-) channel is embedded in the cell membrane of certain neurons. The channel has multiple receptor sites where alcohol, barbiturates, and benzodiazepines bind to exert their effects. The binding of these molecules opens the chloride channel, allowing negatively charged chloride ions (Cl^-) into the neuron's cell body. Changing its charge in a negative direction pushes the neuron *away* from firing; thus, activating a GABA neuron has a quieting effect on the brain. ["Figure 4.17" by CNX OpenStax is licensed under CC BY 4.0.]

benzodiazepines. These drugs share in common their ability to serve as agonists of the gamma-aminobutyric acid (GABA) neurotransmitter system. Because GABA has a quieting effect on the brain, GABA agonists also have a quieting effect; these types of drugs are often prescribed to treat both anxiety and insomnia.

Acute alcohol administration results in a variety of changes to consciousness. At rather low doses, alcohol use is associated with feelings of euphoria. As the dose increases, people report feeling sedated. Generally, alcohol is associated with decreases in reaction time and visual acuity, lowered levels of alertness, and reduction in behavioral control. With excessive alcohol use, a person might experience a complete loss of consciousness and/or difficulty remembering events that occurred during a period of intoxication (McKim & Hancock, 2013). In addition, if a pregnant woman consumes alcohol, her infant may be born with a cluster of birth defects and symptoms collectively called fetal alcohol spectrum disorder (FASD) or fetal alcohol syndrome (FAS).

With repeated use of many central nervous system depressants, such as alcohol, a person becomes physically dependent upon the substance and will exhibit signs of both tolerance and withdrawal. Psychological dependence on these drugs is also possible. Therefore, the abuse potential of central nervous system depressants is relatively high.

Drug withdrawal is usually an aversive experience, and it can be a life-threatening process in individuals who have a long history of very high doses of alcohol and/or barbiturates. This is of such concern that people who are trying to overcome addiction to these substances should only do so under medical supervision.

Stimulants

Stimulants are drugs that tend to increase overall levels of neural activity. Many of these drugs act as agonists of the dopamine neurotransmitter system. Dopamine activity is often associated with reward and craving; therefore, drugs that affect dopamine neurotransmission often have abuse liability. Drugs in this category include cocaine, amphetamines (including methamphetamine), cathinones (i.e., bath salts), MDMA (ecstasy), nicotine, and caffeine.

Cocaine can be taken in multiple ways. While many users snort cocaine, intravenous injection and ingestion are also common. The freebase version of cocaine, known as crack, is a potent, smokable version of the drug. Like many other stimulants, cocaine agonizes the dopamine neurotransmitter system by blocking the reuptake of dopamine in the neuronal synapse.

LINK TO LEARNING

Read this interesting newspaper article describing myths about crack cocaine.

Amphetamines have a mechanism of action quite similar to cocaine in that they block the reuptake of dopamine in addition to stimulating its release (**FIGURE 16.4**). While amphetamines are often abused, they are also commonly prescribed to children diagnosed with attention deficit hyperactivity disorder (ADHD). It may seem counterintuitive that stimulant medications are prescribed to treat a disorder that involves hyperactivity, but the therapeutic effect comes from increases in neurotransmitter activity within certain areas of the brain associated with impulse control.

DIG DEEPER

Crack Cocaine

Crack (**FIGURE 16.3**) is often considered to be more addictive than cocaine itself because it is smokable and reaches the brain very quickly. Crack is often less expensive than other forms of cocaine; therefore, it tends to be a more accessible drug for individuals from impoverished segments of society. During the 1980s, many drug laws were rewritten to punish crack users more severely than cocaine users. This led to discriminatory sentencing with low-income, inner-city minority populations receiving the harshest punishments. The wisdom of these laws has recently been called into question, especially given research that suggests crack may not be more addictive than other forms of cocaine, as previously thought (Haasen & Krausz, 2001; Reinerman, 2007). ■

FIGURE 16.3. Crack rocks like these are smoked to achieve a high. Compared with other routes of administration, smoking a drug allows it to enter the brain more rapidly, which can often enhance the user's experience. ["Rocks of crack cocaine" by Drug Enforcement Administration/Wikimedia Commons is in the public domain.)

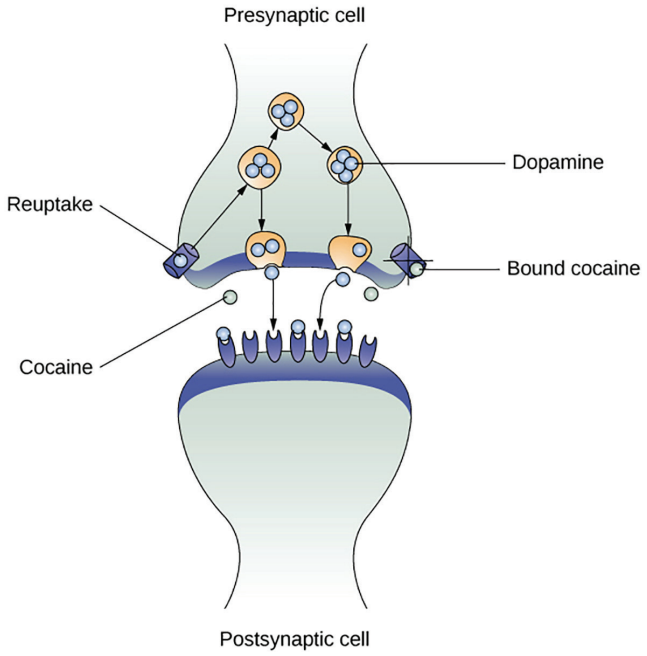

FIGURE 16.4. As one of their mechanisms of action, cocaine and amphetamines block the reuptake of dopamine from the synapse into the presynaptic cell. ["Figure 4.19" by CNX OpenStax is licensed under CC BY 4.0.]

In recent years, methamphetamine (meth) use has become increasingly widespread. **Methamphetamine** is a type of amphetamine that can be made from ingredients that are readily available (e.g., medications containing pseudoephedrine, a compound found in many over-the-counter cold and flu remedies). Despite recent changes in laws designed to make obtaining pseudoephedrine more difficult, methamphetamine continues to be an easily accessible and relatively inexpensive drug option (Shukla et al., 2012).

Users of cocaine, amphetamine, cathinones, and MDMA seek a **euphoric high**—feelings of intense elation and pleasure—especially those who take the drug via intravenous injection or smoking. Repeated use of these stimulants can have significant adverse consequences. Users can experience physical symptoms that include nausea, elevated blood pressure, and increased heart rate. In addition, these drugs can cause feelings of anxiety, hallucinations, and paranoia (Fiorentini et al., 2011). Normal brain functioning is altered after repeated use of these drugs. For example, repeated use can lead to overall depletion among the monoamine neurotransmitters (dopamine, norepinephrine, and serotonin). People may engage in compulsive use of these stimulant substances in part to try to reestablish normal levels of these neurotransmitters (Jayanthi & Ramamoorthy, 2005; Rothman et al., 2007).

Caffeine is another stimulant drug. While it is probably the most commonly used drug in the world, the potency of this particular drug pales in comparison to the other stimulant drugs described in this section. Generally, people use caffeine to maintain increased levels of alertness and arousal. Caffeine is found in many common medicines (such as weight loss drugs), beverages, foods, and even cosmetics (Herman & Herman, 2013). While caffeine may have some indirect effects on dopamine neurotransmission, its primary mechanism of action involves antagonizing adenosine activity (Porkka-Heiskanen, 2011).

While caffeine is generally considered a relatively safe drug, high blood levels of caffeine can result in insomnia, agitation, muscle twitching, nausea, irregular heartbeat, and even death (Reissig et al., 2009; Wolk et al., 2012). In 2012, Kromann and Nielson reported on a case study of a 40-year-old woman who suffered significant ill effects from her use of caffeine. The woman had used caffeine in the past to boost her mood and to provide energy, but over the course of several years, she increased her caffeine consumption to the point that she was consuming three liters of soda each day. Although she had been taking a prescription antidepressant, her symptoms of depression continued to worsen and she began to suffer physically, displaying significant warning signs of cardiovascular disease and diabetes. Upon admission to an outpatient clinic for treatment of mood disorders, she met all of the diagnostic criteria for substance dependence and was advised to dramatically limit her caffeine intake. Once she was able to limit her use to less than 12 ounces of soda a day, both her mental and physical health gradually improved. Despite the prevalence of caffeine use and the large number of people who confess to suffering from caffeine addiction, this was the first published description of soda dependence appearing in scientific literature.

Nicotine is highly addictive, and the use of tobacco products is associated with increased risks of heart disease, stroke, and a variety of cancers. Nicotine exerts its effects through its interaction with acetylcholine receptors. Acetylcholine functions as a neurotransmitter in motor neurons. In the central nervous system, it plays a role in arousal and reward mechanisms. Nicotine is most commonly used in the form of tobacco products like cigarettes or chewing tobacco; therefore, there is a tremendous interest in developing effective smoking cessation techniques. To date, people have used a variety of nicotine replacement therapies in addition to various psychotherapeutic options in an attempt to discontinue their use of tobacco products. In general, smoking cessation programs may be effective in the short term, but it is unclear whether these effects persist (Cropley et al., 2008; Levitt et al., 2007; Smedslund et al., 2004).

Opioids

An **opioid** is one of a category of drugs that includes heroin, morphine, methadone, and codeine. Opioids have analgesic

(a) (b)

FIGURE 16.5. (a) Common paraphernalia for heroin preparation and use are shown here in a needle exchange kit. (b) Heroin is cooked on a spoon over a candle. [(a) "Needle Exchange (brightened)" by Judy Schmitt is a derivative of "Needle Exchange" by Todd Huffman/Flickr, which is licensed under CC BY 2.0; (b) "Heroin" by Psychonaught/ Wikimedia Commons is in the public domain.]

properties; that is, they decrease pain. Humans have an endogenous opioid neurotransmitter system—the body makes small quantities of opioid compounds that bind to opioid receptors, reducing pain and producing euphoria. Thus, opioid drugs, which mimic this endogenous painkilling mechanism, have an extremely high potential for abuse. Natural opioids, called **opiates**, are derivatives of opium, which is a naturally occurring compound found in the poppy plant. There are now several synthetic versions of opiate drugs (correctly called opioids) that have very potent painkilling effects, and they are often abused. For example, the National Institutes of Drug Abuse has sponsored research that suggests the misuse and abuse of the prescription pain killers hydrocodone and oxycodone are significant public health concerns (Maxwell, 2006). In 2013, the U.S. Food and Drug Administration recommended tighter controls on their medical use.

Historically, heroin has been a major opioid drug of abuse (FIGURE 16.5). Heroin can be snorted, smoked, or injected intravenously. Like the stimulants described earlier, the use of heroin is associated with an initial feeling of euphoria followed by periods of agitation. Because heroin is often administered via intravenous injection, users often bear needle track marks on their arms and, like all abusers of intravenous drugs, have an increased risk for contraction of both tuberculosis and HIV.

Aside from their utility as analgesic drugs, opioid-like compounds are often found in cough suppressants, anti-nausea, and anti-diarrhea medications. Given that withdrawal from a drug often involves an experience opposite to the effect of the drug, it should be no surprise that opioid withdrawal resembles a severe case of the flu. While opioid withdrawal can be extremely unpleasant, it is not life-threatening (Julien, 2005). Still, people experiencing opioid withdrawal may be given methadone to make withdrawal from the drug less difficult. **Methadone** is a synthetic opioid that is less euphorigenic than heroin and similar drugs. **Methadone clinics** help people who previously struggled with opioid addiction manage withdrawal symptoms through the use of methadone. Other drugs, including the opioid buprenorphine, have also been used to alleviate symptoms of opiate withdrawal.

Codeine is an opioid with relatively low potency. It is often prescribed for minor pain, and it is available over-the-counter in some other countries. Like all opioids, codeine does have abuse potential. In fact, abuse of prescription opioid medications is becoming a major concern worldwide (Aquina et al., 2009; Casati et al., 2012).

Hallucinogens

A **hallucinogen** is one of a class of drugs that results in profound alterations in sensory and perceptual experiences (FIGURE 16.6). In some cases, users experience vivid visual hallucinations. It is also common for this type of drug to cause hallucinations of body sensations (e.g., feeling as if you are a giant) and a skewed perception of the passage of time.

As a group, hallucinogens are incredibly varied in terms of the neurotransmitter systems they affect. Mescaline and LSD are serotonin agonists, and PCP (angel dust) and ketamine (an animal anesthetic) act as antagonists of the NMDA glutamate receptor. In general, these drugs are not thought to possess the same sort of abuse potential as other classes of drugs discussed in this section.

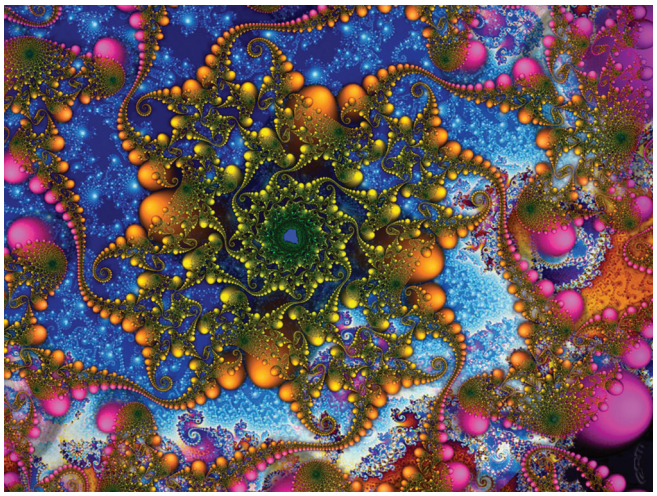

FIGURE 16.6. Psychedelic images like this are often associated with hallucinogenic compounds. ["Psychedelic Curl (rotated)" is a derivative of "psychedelic curl" by new 1lluminati/Flickr, which is licensed under CC BY 2.0.]

DIG DEEPER

Medical Marijuana

While the possession and use of marijuana is illegal in most states, it is now legal in Washington and Colorado to possess limited quantities of marijuana for recreational use (**FIGURE 16.7**). In contrast, medical marijuana use is now legal in nearly half of the United States and in the District of Columbia. Medical marijuana is marijuana that is prescribed by a doctor for the treatment of a health condition. For example, people who undergo chemotherapy will often be prescribed marijuana to stimulate their appetites and prevent excessive weight loss resulting from the side effects of chemotherapy treatment. Marijuana may also have some promise in the treatment of a variety of medical conditions (Mather et al., 2013; Robson, 2014; Schicho & Storr, 2014).

While medical marijuana laws have been passed on a state-by-state basis, federal laws still classify this as an illicit substance, making conducting research on the potentially beneficial medicinal uses of marijuana problematic. There is quite a bit of controversy within the scientific community as to the extent to which marijuana might have medicinal benefits due to a lack of large-scale, controlled research (Bostwick, 2012). As a result, many scientists have urged the federal government to allow for relaxation of current marijuana laws and classifications in order to facilitate a more widespread study of the drug's effects (Aggarwal et al., 2009; Bostwick, 2012; Kogan & Mechoulam, 2007).

Until recently, the United States Department of Justice routinely arrested people involved and seized marijuana used in medicinal settings. In the latter part of 2013, however, the United States Department of Justice issued statements indicating that they would not continue to challenge state medical marijuana laws. This shift in policy may be in response to the scientific community's recommendations and/or reflect changing public opinion regarding marijuana. ■

FIGURE 16.7. Medical marijuana shops are becoming more and more common in the United States. ["IMG_7596" by Neeta Lind/Flickr is licensed under CC BY 2.0.]

LINK TO LEARNING

To learn more about some of the most commonly abused prescription and street drugs, check out the Commonly Abused Drugs Chart and the Commonly Abused Prescription Drugs Chart from the National Institute on Drug Abuse.

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READING 17

Predictive Learning

SOURCE

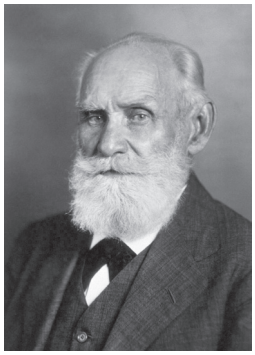
Levy, J. (2019). *Psychology: The science of human potential.* BCcampus. https://pressbooks.bccampus.ca/thescienceofhumanpotential/

KEY TERMS

acquired taste aversion
acquisition
behavioral neuroscientists
classical conditioning
compensatory response
conditioned response (CR)
conditioned stimulus (CS)
extinction
higher-order conditioning
law of contiguity
law of frequency
law of similarity
law of temporal contiguity
learning
neutral stimulus
serendipity
spontaneous recovery
stimulus discrimination
stimulus generalization
unconditioned response (UR)
unconditioned stimulus (US)

One cannot overstate the significance of the contributions Ivan Pavlov made to the study of predictive learning. Pavlov introduced a level of rigor and precision of measurement of both the independent and dependent variables in animal learning that did not exist at the time. In 1904, Pavlov, a physiologist, was awarded the Nobel Prize in Medicine for his research investigating the digestive process in dogs. He became fascinated by an observation he and his laboratory assistants made while conducting this research. One of the digestive processes they studied was salivation. Saliva contains enzymes that initiate the process of breaking down what one eats into basic nutrients required to fuel and repair the body. The subjects frequently started salivating before being placed in the experimental apparatus. Pavlov described this salivation as a "psychic secretion" since it was not being directly elicited by food. He considered the phenomenon so important that within a few years he abandoned his research program in digestion and dedicated the rest of his professional career to systematically studying the details of this basic learning process.

This is a wonderful example of what has been described as **serendipity**, or accidental discovery in science. Dogs have been domesticated for thousands of years. A countless number of people probably observed dogs appearing to predict (i.e., anticipate or expect) food. Pavlov, however, recognized the significance of the observation as an example of a fundamental learning process. We often think of science as requiring new observations. Pavlov's "discovery" of the classical conditioning process is an example of how this is not necessarily the case. One of the characteristics of an exceptional scientist is to recognize the significance of commonly occurring observations.



Ivan Pavlov. ["Ivan Pavlov NLM3" by National Library of Medicine/Wikimedia Commons is in the public domain.]

We will now review the apparatus, methods, and terminology Pavlov developed for studying predictive learning. He adapted an experimental apparatus designed for one scientific field of inquiry (the physiology of digestion) to an entirely different field (adaptive learning). Pavlov made a small surgical incision in the dog's cheek and implanted a tube permitting saliva to be directly collected in a graduated test tube. The amount of saliva could then be accurately measured and graphed as depicted in **FIGURE 17.1**. Predictive learning was

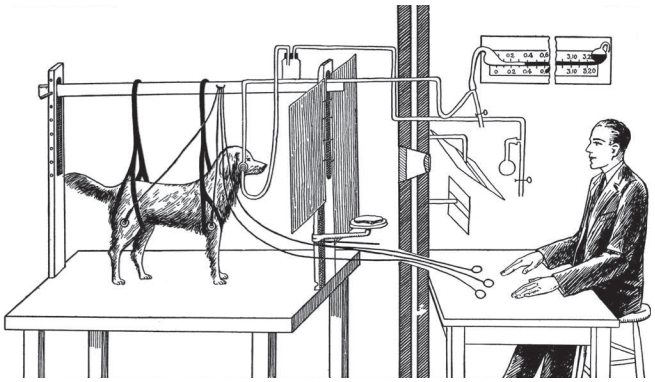


FIGURE 17.1. Pavlov's experiments with a dog. ["Pavlov experiments with dog Wellcome M0014738" by the Wellcome Trust/Wikimedia Commons is licensed under CC BY 4.0.]

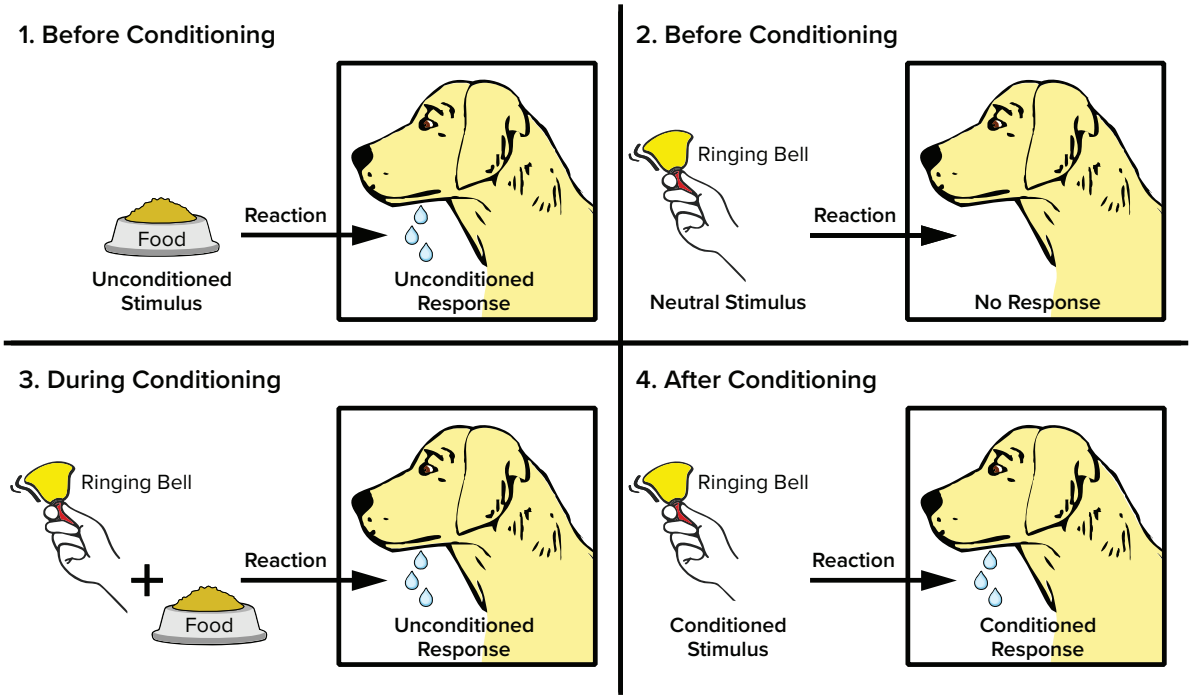


FIGURE 17.2. Pavlov's classical conditioning procedures and terminology. [This work, "Pavlov's Dog (English)," is licensed under CC BY-SA 4.0 by Judy Schmitt. It is a derivative of "Pavlov's dog" by MagentaGreen/ Wikimedia Commons, which is licensed under CC BY-SA 3.0.]

inferred when salivation occurred to a previously neutral stimulus as the result of appropriate experience.

VIDEO CLIP

Watch this video describing Pavlov and classical conditioning.

Animals inherit the tendency to make simple responses (i.e., reflexes) to specific types of stimulation. Pavlov's salivation research was based on the reflexive eliciting of salivation by food (e.g., meat powder). This research was adapted to the study of predictive learning by including a **neutral stimulus**. By neutral, we simply mean that this stimulus did not initially elicit any behavior related to food. Pavlov demonstrated that if a neutral stimulus preceded a biologically significant stimulus on several occasions, one would see a new response occurring to the previously neutral stimulus. **FIGURE 17.2** uses the most popular translation of Pavlov's terminology (which he wrote in Russian). The reflexive behavior was referred to as the **unconditioned response (UR)**. The stimulus that reflexively elicited this response was referred to as the **unconditioned stimulus (US)**. A novel stimulus, by virtue of being paired in a predictive relationship with the food (US), acquires the capacity to elicit a food-related, **conditioned response (CR)**. Once acquiring this capacity, the novel stimulus is considered a **conditioned stimulus (CS)**.

BASIC PREDICTIVE LEARNING PHENOMENA

If predictive learning is a lawful process, controlled empirical investigation has the potential to establish reliable cause-effect relationships. We will see this is the case as we review several basic classical conditioning phenomena. Many of these phenomena were discovered and named by Pavlov himself, starting with the acquisition process described earlier.

Acquisition

The term **acquisition** refers to a procedure or process whereby one stimulus is presented in a predictive relationship with another stimulus. Predictive learning (classical conditioning) is inferred from the occurrence of a new response to the first stimulus. Keeping in mind that mentalistic terms are inferences based upon behavioral observations, it is as though the individual learns to predict *if this happens, then that happens.*

Extinction

The term **extinction** refers to a procedure or process whereby a previously established predictive stimulus is no longer followed by the second stimulus. This typically results in a weakening in the strength of the prior learned response. It is as though the individual learns *what used to happen, doesn't happen anymore.* Extinction is commonly misused as a term describing only the result of the procedure or process. That is, it is often used like the term schizophrenia, which is defined

exclusively on the dependent variable (symptom) side. Extinction is actually more like influenza, in that it is a true explanation standing for the relationship between a specific independent variable (the procedure) and dependent variable (the change in behavior).

VIDEO CLIP

Watch this video describing classical conditioning acquisition and extinction.

Spontaneous Recovery

The term **spontaneous recovery** refers to an increase in the strength of the prior learned response after an extended time period lapses between extinction trials. The individual acts as though, *perhaps what used to happen, still does.*

IS EXTINCTION UNLEARNING OR INHIBITORY LEARNING?

Pavlov was an excellent example of someone who today would be considered a behavioral neuroscientist. In fact, the full title of his classic book (1927) is *Conditioned Reflexes: An Investigation of the Physiological Activity of the Cerebral Cortex*. **Behavioral neuroscientists** study behavior in order to infer underlying brain mechanisms. Thus, Pavlov did not perceive himself as converting from a physiologist into a psychologist when he abandoned his study of digestion to explore the intricacies of classical conditioning. As implied by his "psychic secretion" metaphor, he believed he was continuing to study physiology, turning his attention from studying the digestive system to studying the brain.

One question of interest to Pavlov was the nature of the extinction process. Pavlov assumed that acquisition produced a connection between a sensory neuron representing the conditioned stimulus and a motor neuron eliciting salivation. The reduction in responding resulting from the extinction procedure could result from either breaking this bond (i.e., unlearning) or counteracting it with a competing response. The fact that spontaneous recovery occurs indicates that the bond is not broken during the extinction process. Extinction must involve learning an inhibitory response counteracting the conditioned response. The individual appears to learn that one stimulus no longer predicts another. The conclusion that extinction does not permanently eliminate a previously learned association has important practical and clinical implications. It means that someone who has received treatment for a problem and improved is not the same as a person never requiring treatment in the first place (compare with Bouton, 2000; Bouton & Nelson, 1998). For example, even if someone has quit smoking, there is a greater likelihood of that person's relapsing than a non-smoker's acquiring the habit.

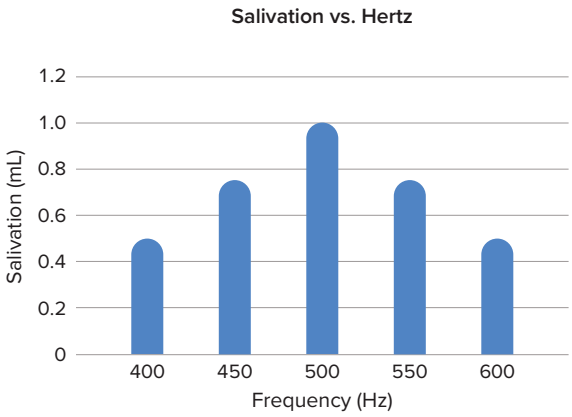


FIGURE 17.3. Stimulus generalization gradient. ["Stimulus Generalization Graph" by Judy Schmitt is licensed under CC BY-NC-SA 4.0.]

STIMULUS GENERALIZATION AND DISCRIMINATION

Imagine if you had to learn to make the same response over and over again to each new situation. Fortunately, this is often not necessary. **Stimulus generalization** refers to the fact that a previously acquired response will occur in the presence of stimuli other than the original one, the likelihood being a function of the degree of similarity. In **FIGURE 17.3**, we see that a response learned to a 500 Hz frequency tone occurs to other stimuli, the percentage of times depending upon how close the frequency is to 500 Hz. It is as though the individual predicts *what happens after one event will happen after similar events.*

The fact that generalization occurs significantly increases the efficiency of individual learning experiences. However, there are usually limits on the appropriateness of making the same response in different situations. For example, new fathers often beam the first time they hear their infant say "dada." They are less thrilled when they hear their child call the mailman "dada!" Usually, it is necessary to conduct additional teaching so that the child only says "dada" in the presence of the father. **Stimulus discrimination** occurs when one stimulus (the S+, e.g., a tone or the father) is predictive of a second stimulus (e.g., food or the word "dada") but a different stimulus (the S–, e.g., a light or the mailman) is never followed by that second stimulus. Eventually the individual responds to the S+ (tone or father) and not to the S– (light or mailman) as though learning *if this happens then that happens, but if this other thing happens that does not happen.*

PAVLOV'S STIMULUS SUBSTITUTION MODEL OF CLASSICAL CONDITIONING

For most of the twentieth century, Pavlov's originally proposed stimulus substitution model of classical conditioning was widely accepted. Pavlov viewed conditioning as a mechanistic (automatic) result of pairing neutral and biologically

significant events in time. He believed that the established conditioned stimulus became a substitute for the original unconditioned stimulus. There were four assumptions underlying this stimulus substitution model:

- Classical conditioning requires a biologically significant stimulus (i.e., US).
- Temporal contiguity between a neutral stimulus and an unconditioned stimulus is *necessary* for the neutral stimulus to become a conditioned stimulus.
- Temporal contiguity between a neutral stimulus and an unconditioned stimulus is *sufficient* for the neutral stimulus to become a conditioned stimulus.
- The conditioned response will always resemble if not be identical to the unconditioned response.

Does Classical Conditioning Require a Biologically Significant Stimulus?

Higher-order conditioning is a procedure or process whereby a previously neutral stimulus is presented in a predictive relationship with a second, previously established, predictive stimulus. **Learning** is inferred from the occurrence of a new response in the presence of this previously neutral stimulus. For example, after pairing the tone with food, it is possible to place the tone in the position of the US by presenting a light immediately before it occurs. Research indicates that a conditioned response (salivation, in this case) will occur to the light even though it was not paired with a biologically significant stimulus (food).

VIDEO CLIP

Watch this video for a demonstration of higher-order conditioning.

Is Temporal Contiguity Necessary for Conditioning?

Human beings have speculated about the learning process since at least the time of the early Greek philosophers. Aristotle, in the fourth century BCE, proposed three laws of association that he believed applied to human thought and memory. The **law of contiguity** stated that objects or events occurring close in time (temporal contiguity) or space (spatial contiguity) become associated. The **law of similarity** stated that we tend to associate objects or events having features in common such that observing one event will prompt recall of similar events. The **law of frequency** stated that the more often we experience objects or events, the more likely we will be to remember them. In a sense, Pavlov created a methodology permitting empirical testing of Aristotle's laws. The law that applies in this section is the **law of temporal contiguity**. Timing effects, like many variables studied scientifically, lend themselves to parametric studies in which the independent variable consists of different values on a dimension. It has been demonstrated that human eyelid conditioning in which a light is followed by a puff of air to the eye is strongest when the puff occurs approximately 500 milliseconds (½ second) after the light. The strength of conditioning at shorter or longer intervals drops off within tenths of a second. Thus, temporal contiguity appears critical in human eyelid conditioning, consistent with Pavlov's second assumption.

An Exception: Acquired Taste Aversion

Acquired taste aversion is the only apparent exception to the necessity of temporal contiguity in predictive learning (classical conditioning). This exception can be understood as an evolutionary adaptation to protect animals from food poisoning. Imagine if members of the Nukak—an indigenous tribe in Colombia that is said to be at imminent risk of extinction—got sick after eating a particular food and continued to eat the same substance. There is a good chance the tribe members (and tribe!) would not survive for long. It would be advantageous to avoid foods one ate prior to becoming ill, even if the symptoms did not appear for several minutes or even hours. The phenomenon of acquired taste aversion has been studied extensively. The time intervals used sometimes differ by hours rather than seconds or tenths of seconds. For example, rats were made sick by being exposed to X-rays after drinking sweet water (Smith & Roll, 1967). Rats have a strong preference for sweet water, drinking it approximately 80% of the time when given a choice with ordinary tap water. If the rat became sick within ½ hour, sweet-water drinking was totally eliminated. With intervals of 1 to 6 hours, it was reduced from 80% to 10%. There was even evidence of an effect after a 24-hour delay! Pavlov's dogs would not associate a tone with presentation of food an hour later, let alone 24 hours. The acquired aversion to sweet water can be interpreted as either an exception to the law of temporal contiguity or contiguity must be considered on a time scale of different orders of magnitude (hours rather than seconds).

Is Temporal Contiguity Sufficient for Conditioning?

Pavlov believed not only that temporal contiguity between CS and US was necessary for conditioning to occur but also that *it was all* that is necessary (i.e., that it was sufficient). Rescorla (1966, 1968, 1988) has demonstrated that the correlation between CS and US (i.e., the extent to which the CS predicted the US) was more important then temporal contiguity. For example, if the only time one gets shocked is in the presence of the tone, then the tone correlates with shock (i.e., is predictive of the shock). If one is shocked the same amount whether the tone is present or not, the tone does not correlate with shock (i.e., provides no predictive information). Rescorla demonstrated that despite temporal contiguity between tone

and shock in both instances, classical conditioning would be strong in the first case and not occur in the second.

Another example of the lack of predictive learning despite temporal contiguity between two events is provided in a study by Leon Kamin (1969). A blocking group received a tone (CS 1) followed by shock (US) in the first phase, while a control group was simply placed in the chamber. The groups were identical from then on. During the second phase, a compound stimulus consisting of the light and a tone (CS 2) was followed by shock. During a test phase, each component was presented by itself to determine the extent of conditioning.

In the blocking group, conditioning occurred to the tone and not to the light. Conditioning occurred to both elements of the compound in the control group. It is as though the previous experience with the tone resulted in the blocking-group subjects not paying attention to the light in the second phase. The light was redundant. It did not provide additional information.

A novel and fun demonstration of blocking in college students involved a computerized video game (Arcediano et al., 1997). Subjects used a laser gun (the space bar) to try to protect the earth from invasion by Martians. Unfortunately, the enterprising Martians had developed an anti-laser shield. If the subject fired when the shield was in place, their laser-gun would be ineffective, permitting a bunch of Martians to land and do their mischief. A flashing light preceded implementation of the laser-shield for subjects in the blocking group. A control group did not experience a predictive stimulus for the laser-shield. Subsequently, both groups experienced a compound stimulus consisting of the flashing light and a complex tone. The control group associated the tone with activation of the laser-shield, whereas, due to their previous history with the light, the blocking group did not. For them, the tone was redundant.

VIDEO CLIP

Watch this video for a demonstration of blocking.

The blocking procedure demonstrates that temporal contiguity between events, even in a predictive relationship, is not sufficient for learning to occur. In the second phase of the blocking procedure, the compound stimulus precedes the US. According to Pavlov, since both components are contiguous with the US, both should become associated with it and eventually elicit CRs. The combination of Rescorla's (1966) and Kamin's (1969) findings lead to the conclusion that learning occurs when individuals obtain *new* information enabling them to predict events they were unable to previously predict. Kamin suggested that this occurs only when we are surprised. That is, as long as events are proceeding as expected, we do not learn. Once something unexpected occurs, individuals search for relevant information. Many of our activities may be described as "habitual" (Kirsch et al., 2004) or "automatic" (Aarts & Dijksterhuis, 2000). We have all had the experience of riding a bike or driving as though we are on "autopilot." We are not consciously engaged in steering as long as events are proceeding normally. Once something unexpected occurs we snap to attention and focus on the immediate environmental circumstances. This provides the opportunity to acquire new information. This is a much more active and adaptive understanding of predictive learning than that provided by Pavlov's stimulus substitution model (see Rescorla, 1988).

Must the Conditioned Response Resemble the Unconditioned Response?

We will now examine the fourth assumption of Pavlov's model, that the conditioned response always resembles the unconditioned response. Meat powder reflexively elicits salivation, and Pavlov observed the same reaction to a conditioned stimulus predictive of meat powder. Puffs of air reflexively elicit eye blinks, and taps on the knee elicit knee jerks. The conditioned responses are similar to the unconditioned responses in research involving puffs of air and knee taps as unconditioned stimuli. It is understandable that Pavlov and others believed for so long that the conditioned response must resemble if not be identical to the unconditioned response. However, Zener (1937, p. 393) took movies of dogs undergoing salivary conditioning and disagreed with this conclusion. He observed, "Despite Pavlov's assertions, the dog does not appear to be eating an imaginary food. . . . It is a different response, anthropomorphically describable as a looking for, expecting, the fall of food with a readiness to perform the eating behavior which will occur when the food falls."

Kimble (1961, p. 54) offered the possible interpretation that "the function of the conditioned response is to prepare the organism for the occurrence of the unconditioned stimulus." Research by Shepard Siegel (1975, 1977, 1984, 2005) has swung the pendulum toward widespread acceptance of this interpretation of the nature of the conditioned response. Siegel's research involved administration of a drug as the unconditioned stimulus. For example, rats were injected with insulin in the presence of a novel stimulus (Siegel, 1975). Insulin is a drug that lowers blood sugar level and is often used to treat diabetics. Eventually, a conditioned response was developed to the novel stimulus (now a CS). However, rather than lowering blood sugar level, the blood sugar level *increased* to the CS. Siegel described this increase as a **compensatory response** in preparation for the effect of insulin. He argued that it was similar to other homeostatic mechanisms designed to maintain optimal levels of biological processes (e.g., temperature, white blood cell count, fluid levels, etc.). Similar compensatory responses have been demonstrated

with morphine, a drug having analgesic properties (Siegel, 1977) and with caffeine (Siegel, 2005). Siegel (2008) has gone so far as to suggest that "the learning researcher is a homeostasis researcher."

Siegel has developed a fascinating and influential model of drug tolerance and overdose effects based upon his findings concerning the acquisition of compensatory responses (Siegel, 1983). He suggested that many so-called heroin overdoses are actually the result of the same dosage being consumed differently or in a different environment. Such an effect has actually been demonstrated experimentally with rats. Whereas 34% of rats administered a higher than usual dosage of heroin in the same cage died, 64% administered the same dosage in a different cage died (Siegel et al., 1982). As an experiment, this study has high internal validity but obviously could not be replicated with human subjects. In a study with high external validity, Siegel (1984) interviewed survivors of suspected heroin overdoses. Most insisted they had taken the usual quantity but indicated that they had used a different technique or consumed the drug in a different environment. This combination of high external validity and high internal validity results makes a compelling case for Siegel's learning model of drug tolerance and overdose effects.

Drug-induced compensatory responses are consistent with the interpretation that the conditioned response constitutes preparation for the unconditioned stimulus. Combining this interpretation with the conclusions reached regarding the necessity of predictiveness for classical conditioning to occur leads to the following alternative to Pavlov's stimulus substitution model: ***Classical conditioning*** *is an adaptive process whereby individuals acquire the ability to predict future events and prepare for their occurrence.*

EXERCISES

1. Describe the basis for concluding that extinction is an inhibitory as opposed to an unlearning process.
2. Define and give examples of the following classical conditioning phenomena: acquisition, extinction, spontaneous recovery, stimulus generalization, and stimulus discrimination.
3. Explain how the fact that spontaneous recovery occurs indicates that the connection between a conditioned stimulus and conditioned response is not broken during the extinction process.
4. State the assumptions underlying Pavlov's stimulus substitution model of classical conditioning. Describe the research findings addressing each of the assumptions. Show how the research findings are consistent with the description of classical conditioning as an adaptive learning process.

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READING 18

Operant Conditioning

SOURCE

OpenStax. (2019). *Psychology.* OpenStax CNX. https://openstax.org/details/books/psychology

LEARNING OBJECTIVES

- Define operant conditioning.
- Explain the difference between reinforcement and punishment.
- Distinguish between reinforcement schedules.

KEY TERMS

cognitive map
continuous reinforcement
fixed interval reinforcement schedule
fixed ratio reinforcement schedule
latent learning
law of effect
negative punishment
negative reinforcement
operant conditioning
partial reinforcement
positive punishment
positive reinforcement
primary reinforcer
punishment
secondary reinforcer
shaping
variable interval reinforcement schedule
variable ratio reinforcement schedule

The previous reading focused on the type of associative learning known as classical conditioning. Remember that in classical conditioning, something in the environment triggers a reflex automatically, and researchers train the organism to react to a different stimulus. Now we turn to the second type of associative learning, **operant conditioning**. In operant conditioning, organisms learn to associate a behavior and its consequence (TABLE 18.1). A pleasant consequence makes that behavior more likely to be repeated in the future. For example, Spirit, a dolphin at the National Aquarium in Baltimore, does a flip in the air when her trainer blows a whistle. The consequence is that she gets a fish.

Psychologist B. F. Skinner saw that classical conditioning is limited to existing behaviors that are reflexively elicited, and it doesn't account for new behaviors such as riding a bike. He proposed a theory about how such behaviors come about. Skinner believed that behavior is motivated by the consequences we receive for the behavior: the reinforcements and punishments. His idea that learning is the result of consequences is based on the law of effect, which was first proposed by psychologist Edward Thorndike.

According to the **law of effect**, behaviors that are followed by consequences that are satisfying to the organism are more likely to be repeated, and behaviors that are followed by unpleasant consequences are less likely to be repeated (Thorndike, 1898). Essentially, if an organism does something that brings about a desired result, the organism is more likely to do it again. If an organism does something that does not bring about a desired result, the organism is less likely to do it again. An example of the law of effect is in employment. One of the reasons (and often the main reason) we show up for work is because we get paid to do so. If we stop getting paid, we will likely stop showing up—even if we love our job.

Working with Thorndike's law of effect as his foundation, Skinner began conducting scientific experiments on animals (mainly rats and pigeons) to determine how organisms learn

TABLE 18.1. Classical and Operant Conditioning Compared

	Classical Conditioning	Operant Conditioning
Conditioning approach	An unconditioned stimulus (such as food) is paired with a neutral stimulus (such as a bell). The neutral stimulus eventually becomes the conditioned stimulus, which brings about the conditioned response (salivation).	The target behavior is followed by reinforcement or punishment to either strengthen or weaken it, so that the learner is more likely to exhibit the desired behavior in the future.
Stimulus timing	The stimulus occurs immediately before the response.	The stimulus (either reinforcement or punishment) occurs soon after the response.

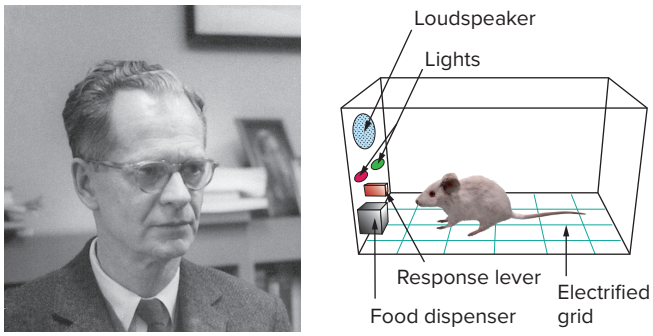

FIGURE 18.1. (a) B. F. Skinner developed operant conditioning for systematic study of how behaviors are strengthened or weakened according to their consequences. (b) In a Skinner box, a rat presses a lever in an operant conditioning chamber to receive a food reward. [(a) "B.F. Skinner at Harvard circa 1950" by Silly rabbit/ Wikimedia Commons is licensed under CC BY 3.0; (b) "Skinner Box" by Judy Schmitt is licensed under CC BY-NC-SA 4.0.]

through operant conditioning (Skinner, 1938). He placed these animals inside an operant conditioning chamber, which has come to be known as a "Skinner box" (**FIGURE 18.1**). A Skinner box contains a lever (for rats) or disk (for pigeons) that the animal can press or peck for a food reward via the dispenser. Speakers and lights can be associated with certain behaviors. A recorder counts the number of responses made by the animal.

LINK TO LEARNING

Watch this brief video clip to learn more about operant conditioning: Skinner is interviewed, and operant conditioning of pigeons is demonstrated.

In discussing operant conditioning, we use several everyday words—positive, negative, reinforcement, and punishment—in a specialized manner. In operant conditioning, positive and negative do not mean good and bad. Instead, *positive* means you are adding something, and *negative* means you are taking something away. *Reinforcement* means you are increasing a behavior, and *punishment* means you are decreasing a behavior. Reinforcement can be positive or negative, and punishment can also be positive or negative. All reinforcers (positive or negative) *increase* the likelihood of a behavioral response. All punishers (positive or negative) *decrease* the likelihood of a behavioral response. Now let's combine these four terms: positive reinforcement, negative reinforcement, positive punishment, and negative punishment (**TABLE 18.2**).

TABLE 18.2. Positive and Negative Reinforcement and Punishment

	Reinforcement	Punishment
Positive	Something is *added* to *increase* the likelihood of a behavior.	Something is *added* to *decrease* the likelihood of a behavior.
Negative	Something is *removed* to *increase* the likelihood of a behavior.	Something is *removed* to *decrease* the likelihood of a behavior.

REINFORCEMENT

The most effective way to teach a person or animal a new behavior is with positive reinforcement. In **positive reinforcement**, a desirable stimulus is added to increase a behavior.

For example, you tell your 5-year-old son, Jerome, that if he cleans his room, he will get a toy. Jerome quickly cleans his room because he wants a new art set. Let's pause for a moment. Some people might say, "Why should I reward my child for doing what is expected?" But in fact we are constantly and consistently rewarded in our lives. Our paychecks are rewards, as are high grades and acceptance into our preferred school. Being praised for doing a good job and for passing a driver's test is also a reward. Positive reinforcement as a learning tool is extremely effective. It has been found that one of the most effective ways to increase achievement in school districts with below-average reading scores was to pay the children to read. Specifically, second-grade students in Dallas were paid $2 each time they read a book and passed a short quiz about the book. The result was a significant increase in reading comprehension (Fryer, 2010). What do you think about this program? If Skinner were alive today, he would probably think this was a great idea. He was a strong proponent of using operant conditioning principles to influence students' behavior at school. In fact, in addition to the Skinner box, he also invented what he called a teaching machine that was designed to reward small steps in learning (Skinner, 1961)—an early forerunner of computer-assisted learning. His teaching machine tested students' knowledge as they worked through various school subjects. If students answered questions correctly, they received immediate positive reinforcement and could continue; if they answered incorrectly, they did not receive any reinforcement. The idea was that students would spend additional time studying the material to increase their chance of being reinforced the next time (Skinner, 1961).

In **negative reinforcement**, an undesirable stimulus is removed to increase a behavior. For example, car manufacturers use the principles of negative reinforcement in their seatbelt systems, which go "beep, beep, beep" until you fasten your seatbelt. The annoying sound stops when you exhibit the desired behavior, increasing the likelihood that you will buckle up in the future. Negative reinforcement is also used

frequently in horse training. Riders apply pressure—by pulling the reins or squeezing their legs—and then remove the pressure when the horse performs the desired behavior, such as turning or speeding up. The pressure is the negative stimulus that the horse wants to remove.

PUNISHMENT

Many people confuse negative reinforcement with punishment in operant conditioning, but they are two very different mechanisms. Remember that reinforcement, even when it is negative, always increases a behavior. In contrast, **punishment** always decreases a behavior. In **positive punishment**, you add an undesirable stimulus to decrease a behavior. An example of positive punishment is scolding a student to get the student to stop texting in class. In this case, a stimulus (the reprimand) is added in order to decrease the behavior (texting in class). In **negative punishment**, you remove an aversive stimulus to decrease behavior. For example, when a child misbehaves, a parent can take away a favorite toy. In this case, a stimulus (the toy) is removed in order to decrease the behavior.

Punishment, especially when it is immediate, is one way to decrease undesirable behavior. For example, imagine your 6-year-old son, Brandon, hit his younger brother. You have Brandon write 100 times "I will not hit my brother" (positive punishment). Chances are he won't repeat this behavior. While strategies like this are common today, in the past children were often subject to physical punishment, such as spanking. It's important to be aware of some of the drawbacks in using physical punishment on children. First, punishment may teach fear. If Brandon is spanked for running into the street, he may become fearful of the street, but he also may become fearful of the person who delivered the punishment—you, his parent. Similarly, children who are punished by teachers may come to fear the teacher and try to avoid school (Gershoff et al., 2010). Consequently, most schools in the United States have banned corporal punishment. Second, punishment may cause children to become more aggressive and prone to antisocial behavior and delinquency (Gershoff, 2002). They see their parents resort to spanking when they become angry and frustrated, so, in turn, they may act out this same behavior when they become angry and frustrated. For example, because you spank Brenda when you are angry with her for her misbehavior, she might start hitting her friends when they won't share their toys.

While positive punishment can be effective in some cases, Skinner suggested that the use of punishment should be weighed against the possible negative effects. Today's psychologists and parenting experts favor reinforcement over punishment—they recommend that you catch your child doing something good and reward her for it.

Shaping

In his operant conditioning experiments, Skinner often used an approach called shaping. Instead of rewarding only the target behavior, in **shaping**, we reward successive approximations of a target behavior. Why is shaping needed? Remember that in order for reinforcement to work, the organism must first display the behavior. Shaping is needed because it is extremely unlikely that an organism will display anything but the simplest of behaviors spontaneously. In shaping, behaviors are broken down into many small, achievable steps. The specific steps used in the process are the following:

1. Reinforce any response that resembles the desired behavior.
2. Then reinforce the response that more closely resembles the desired behavior. You will no longer reinforce the previously reinforced response.
3. Next, begin to reinforce the response that even more closely resembles the desired behavior.
4. Continue to reinforce closer and closer approximations of the desired behavior.
5. Finally, only reinforce the desired behavior.

Shaping is often used in teaching a complex behavior or chain of behaviors. Skinner used shaping to teach pigeons not only such relatively simple behaviors as pecking a disk in a Skinner box, but also many unusual and entertaining behaviors, such as turning in circles, walking in figure eights, and even playing ping pong; the technique is commonly used by animal trainers today. An important part of shaping is stimulus discrimination. Recall Pavlov's dogs—he trained them to respond to the tone of a bell, and not to similar tones or sounds. This discrimination is also important in operant conditioning and in shaping behavior.

LINK TO LEARNING

Here is a brief video of Skinner's pigeons playing ping pong.

It's easy to see how shaping is effective in teaching behaviors to animals, but how does shaping work with humans? Let's consider parents whose goal is to have their child learn to clean his room. They use shaping to help him master steps toward the goal. Instead of performing the entire task, they set up these steps and reinforce each step. First, he cleans up one toy. Second, he cleans up five toys. Third, he chooses whether to pick up ten toys or put his books and clothes away. Fourth, he cleans up everything except two toys. Finally, he cleans his entire room.

PRIMARY AND SECONDARY REINFORCERS

Rewards such as stickers, praise, money, toys, and more can be used to reinforce learning. Let's go back to Skinner's rats again. How did the rats learn to press the lever in the Skinner

box? They were rewarded with food each time they pressed the lever. For animals, food would be an obvious reinforcer.

What would be a good reinforcer for humans? For your daughter Sydney, it was the promise of a toy if she cleaned her room. How about Joaquin, the soccer player? If you gave Joaquin a piece of candy every time he made a goal, you would be using a **primary reinforcer**. Primary reinforcers are reinforcers that have innate reinforcing qualities. These kinds of reinforcers are not learned. Water, food, sleep, shelter, sex, and touch, among others, are primary reinforcers. Pleasure is also a primary reinforcer. Organisms do not lose their drive for these things. For most people, jumping in a cool lake on a

EVERYDAY CONNECTION

Behavior Modification in Children

Parents and teachers often use behavior modification to change a child's behavior. Behavior modification uses the principles of operant conditioning to accomplish behavior change so that undesirable behaviors are switched for more socially acceptable ones. Some teachers and parents create a sticker chart, in which several behaviors are listed (**FIGURE 18.2**). Sticker charts are a form of token economies, as described in the text. Each time children perform the behavior, they get a sticker, and after a certain number of stickers, they get a prize, or reinforcer. The goal is to increase acceptable behaviors and decrease misbehavior. Remember, it is best to reinforce desired behaviors, rather than to use punishment. In the classroom, the teacher can reinforce a wide range of behaviors in students, from raising their hands, to walking quietly in the hall, to turning in their homework. At home, parents might create a behavior chart that rewards children for things such as putting away toys, brushing their teeth, and helping with dinner. In order for behavior modification to be effective, the reinforcement needs to be connected with the behavior; the reinforcement must matter to the child and be done consistently.

Time-out is another popular technique used in behavior modification with children. It operates on the principle of negative punishment. When a child demonstrates an undesirable behavior, she is removed from the desirable activity at hand (**FIGURE 18.3**). For example, say that Sophia and her brother Mario are playing with building blocks. Sophia throws some blocks at her brother, so you give her a warning that she will go to time-out if she does it again. A few minutes later, she throws more blocks at Mario. You remove Sophia from the room for a few minutes. When she comes back, she doesn't throw blocks.

There are several important points that you should know if you plan to implement time-out as a behavior modification technique. First, make sure the child is being removed from a desirable activity and placed in a less desirable location. If the activity is something undesirable for the child, this technique will backfire because it is more enjoyable for the child to be removed from the activity. Second, the length of the time-out is important. The general rule of thumb is one minute for each year of the child's age. Sophia is five; therefore, she sits in a time-out for five minutes. Setting a timer helps children know how long they have to sit in time-out. Finally, as a caregiver, keep several guidelines in mind over the course of a time-out: remain calm when directing your child to time-out; ignore your child during time-out (because caregiver attention may reinforce misbehavior); and give the child a hug or a kind word when time-out is over. ■

FIGURE 18.2. Sticker charts are a form of positive reinforcement and a tool for behavior modification. Once this little girl earns a certain number of stickers for demonstrating a desired behavior, she will be rewarded with a trip to the ice cream parlor. ["IMG_3574" by Abigail Batchelder/Flickr is licensed under CC BY 2.0.]

(a) (b)

FIGURE 18.3. Time-out is a popular form of negative punishment used by caregivers. When a child misbehaves, he or she is removed from a desirable activity in an effort to decrease the unwanted behavior. For example, a child might be playing on the playground with friends and push another child (a); the child who misbehaved would then be removed from the activity for a short period of time (b). ["Celio Azzurro" by Simone Ramella/Flickr (a) and "Timeout" by Jeff Turner/Flickr (b) are licensed under CC BY 2.0.]

very hot day would be reinforcing and the cool lake would be innately reinforcing—the water would cool the person off (a physical need), as well as provide pleasure.

A **secondary reinforcer** has no inherent value and only has reinforcing qualities when linked with a primary reinforcer. Praise, linked to affection, is one example of a secondary reinforcer, as when you called out "Great shot!" every time Joaquin made a goal. Another example, money, is only worth something when you can use it to buy other things—either things that satisfy basic needs (food, water, shelter—all primary reinforcers) or other secondary reinforcers. If you were on a remote island in the middle of the Pacific Ocean and you had stacks of money, the money would not be useful if you could not spend it. What about stickers on a behavior chart? They also are secondary reinforcers.

Sometimes, instead of stickers on a sticker chart, a token is used. Tokens, which are also secondary reinforcers, can then be traded in for rewards and prizes. Entire behavior management systems, known as token economies, are built around the use of these kinds of token reinforcers. Token economies have been found to be very effective at modifying behavior in a variety of settings such as schools, prisons, and mental hospitals. For example, a study by Cangi and Daly (2013) found that use of a token economy increased appropriate social behaviors and reduced inappropriate behaviors in a group of autistic school children. Autistic children tend to exhibit disruptive behaviors such as pinching and hitting. When the children in the study exhibited appropriate behavior (not hitting or pinching), they received a "quiet hands" token. When they hit or pinched, they lost a token. The children could then exchange specified amounts of tokens for minutes of playtime.

REINFORCEMENT SCHEDULES

Remember, the best way to teach a person or animal a behavior is to use positive reinforcement. For example, Skinner used positive reinforcement to teach rats to press a lever in a Skinner box. At first, the rat might randomly hit the lever while exploring the box, and out would come a pellet of food. After eating the pellet, what do you think the hungry rat did next? It hit the lever again, and received another pellet of food. Each time the rat hit the lever, a pellet of food came out. When an organism receives a reinforcer each time it displays a behavior, it is called **continuous reinforcement**. This reinforcement schedule is the quickest way to teach someone a behavior, and it is especially effective in training a new behavior. Let's consider a dog that is learning to sit on command. Now, each time he sits, you give him a treat. Timing is important here: you will be most successful if you present the reinforcer immediately after he sits, so that he can make an association between the target behavior (sitting) and the consequence (getting a treat).

LINK TO LEARNING

Watch this video clip where veterinarian Dr. Sophia Yin shapes a dog's behavior using the steps outlined above.

Once a behavior is trained, researchers and trainers often turn to another type of reinforcement schedule—partial reinforcement. In **partial reinforcement**, also referred to as intermittent reinforcement, the person or animal does not get reinforced every time they perform the desired behavior. There are several different types of partial reinforcement schedules (TABLE 18.3). These schedules are described as either fixed or variable, and as either interval or ratio. *Fixed* refers to the number of responses between reinforcements, or the amount of time between reinforcements, which is set and unchanging. *Variable* refers to the number of responses or amount of time between reinforcements, which varies or changes. *Interval* means the schedule is based on the time between reinforcements, and *ratio* means the schedule is based on the number of responses between reinforcements.

TABLE 18.3. Reinforcement Schedules

Reinforcement Schedule	Description	Result	Example
Fixed interval	Reinforcement is delivered at predictable time intervals (e.g., after 5, 10, 15, and 20 minutes).	Moderate response rate with significant pauses after reinforcement	Hospital patient uses patient-controlled, doctor-timed pain relief
Variable interval	Reinforcement is delivered at unpredictable time intervals (e.g., after 5, 7, 10, and 20 minutes).	Moderate yet steady response rate	Checking Facebook
Fixed ratio	Reinforcement is delivered after a predictable number of responses (e.g., after 2, 4, 6, and 8 responses).	High response rate with pauses after reinforcement	Piecework—factory worker getting paid for every *x* number of items manufactured
Variable ratio	Reinforcement is delivered after an unpredictable number of responses (e.g., after 1, 4, 5, and 9 responses).	High and steady response rate	Gambling

Now let's combine these four terms. A **fixed interval reinforcement schedule** is when behavior is rewarded after a set amount of time. For example, June undergoes major surgery in a hospital. During recovery, she is expected to experience pain and will require prescription medications for pain relief. June is given an IV drip with a patient-controlled painkiller. Her doctor sets a limit: one dose per hour. June pushes a button when pain becomes difficult, and she receives a dose of medication. Since the reward (pain relief) only occurs on a fixed interval, there is no point in exhibiting the behavior when it will not be rewarded.

With a **variable interval reinforcement schedule**, the person or animal gets the reinforcement based on varying amounts of time, which are unpredictable. Say that Manuel is the manager at a fast-food restaurant. Every once in a while someone from the quality control division comes to Manuel's restaurant. If the restaurant is clean and the service is fast, everyone on that shift earns a $20 bonus. Manuel never knows when the quality control person will show up, so he always tries to keep the restaurant clean and ensures that his employees provide prompt and courteous service. His productivity regarding prompt service and keeping a clean restaurant are steady because he wants his crew to earn the bonus.

With a **fixed ratio reinforcement schedule**, there are a set number of responses that must occur before the behavior is rewarded. Carla sells glasses at an eyeglass store, and she earns a commission every time she sells a pair of glasses. She always tries to sell people more pairs of glasses, including prescription sunglasses or a backup pair, so she can increase her commission. She does not care if the person really needs the prescription sunglasses, Carla just wants her bonus. The quality of what Carla sells does not matter because her commission is not based on quality; it's only based on the number of pairs sold. This distinction in the quality of performance can help determine which reinforcement method is most appropriate for a particular situation. Fixed ratios are better suited to optimize the quantity of output, whereas a fixed interval, in which the reward is not quantity based, can lead to a higher quality of output.

In a **variable ratio reinforcement schedule**, the number of responses needed for a reward varies. This is the most powerful partial reinforcement schedule. An example of the variable ratio reinforcement schedule is gambling. Imagine that Sarah—generally a smart, thrifty woman—visits Las Vegas for the first time. She is not a gambler, but out of curiosity she puts a quarter into the slot machine, and then another, and another. Nothing happens. Two dollars in quarters later, her curiosity is fading, and she is just about to quit. But then, the machine lights up, bells go off, and Sarah gets 50 quarters back. That's more like it! Sarah gets back to inserting quarters with renewed interest, and a few minutes later she has used up all her gains and is $10 in the hole. Now might be a sensible time to quit. And yet, she keeps putting money into the slot machine because she never knows when the next reinforcement is coming. She keeps thinking that with the next quarter she could win $50, or $100, or even more. Because the reinforcement schedule in most types of gambling has a variable ratio schedule, people keep trying and hoping that the next time they will win big. This is one of the reasons that gambling is so addictive—and so resistant to extinction.

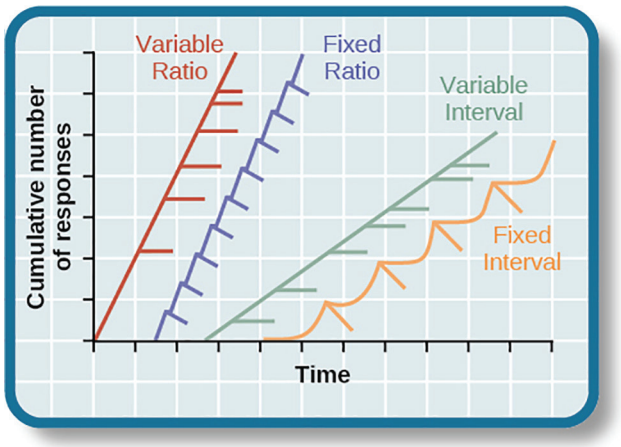

FIGURE 18.4. The four reinforcement schedules yield different response patterns. The variable ratio schedule is unpredictable and yields high and steady response rates, with little if any pause after reinforcement (e.g., gambler). A fixed ratio schedule is predictable and produces a high response rate, with a short pause after reinforcement (e.g., eyeglass saleswoman). The variable interval schedule is unpredictable and produces a moderate, steady response rate (e.g., restaurant manager). The fixed interval schedule yields a scallop-shaped response pattern, reflecting a significant pause after reinforcement (e.g., surgery patient). ["Figure 6.13" by OpenStax is licensed under CC BY 4.0.]

In operant conditioning, extinction of a reinforced behavior occurs at some point after reinforcement stops, and the speed at which this happens depends on the reinforcement schedule. In a variable ratio schedule, the point of extinction comes very slowly, as described above in the slot-machine example. But in the other reinforcement schedules, extinction may come quickly. For example, if June presses the button for the pain relief medication before the allotted time her doctor has approved, no medication is administered. She is on a fixed interval reinforcement schedule (dosed hourly), so extinction occurs quickly when reinforcement doesn't come at the expected time. Among the reinforcement schedules, variable ratio is the most productive and the most resistant to extinction. Fixed interval is the least productive and the easiest to extinguish (**FIGURE 18.4**).

COGNITION AND LATENT LEARNING

Although strict behaviorists such as Skinner and Watson refused to believe that cognition (such as thoughts and expectations) plays a role in learning, another behaviorist, Edward C. Tolman, had a different opinion. Tolman's experiments with rats demonstrated that organisms can learn even if they do not receive

CONNECT THE CONCEPTS

Gambling and the Brain

Skinner (1953) stated, "If the gambling establishment cannot persuade a patron to turn over money with no return, it may achieve the same effect by returning part of the patron's money on a variable-ratio schedule" (p. 397).

Skinner uses gambling as an example of the power and effectiveness of conditioning behavior based on a variable ratio reinforcement schedule. In fact, Skinner was so confident in his knowledge of gambling addiction that he even claimed he could turn a pigeon into a pathological gambler ("Skinner's Utopia," 1971). Beyond the power of variable ratio reinforcement, gambling seems to work on the brain in the same way as some addictive drugs. The Illinois Institute for Addiction Recovery (n.d.) reports evidence suggesting that pathological gambling is an addiction similar to a chemical addiction (**FIGURE 18.5**). Specifically, gambling may activate the reward centers of the brain, much like cocaine does. Research has shown that some pathological gamblers have lower levels of the neurotransmitter (brain chemical) known as norepinephrine than do normal gamblers (Roy et al., 1988). According to a study conducted by Alec Roy and colleagues, norepinephrine is secreted when a person feels stress, arousal, or thrill; pathological gamblers use gambling to increase their levels of this neurotransmitter. Another researcher, neuroscientist Hans Breiter, has done extensive research on gambling and its effects on the brain. Breiter (as cited in Franzen, 2001) reports that "Monetary reward in a gambling-like experiment produces brain activation very similar to that observed in a cocaine addict receiving an infusion of cocaine" (para. 1). Deficiencies in serotonin (another neurotransmitter) might also contribute to compulsive behavior, including a gambling addiction.

FIGURE 18.5. Some research suggests that pathological gamblers use gambling to compensate for abnormally low levels of the hormone norepinephrine, which is associated with stress and is secreted in moments of arousal and thrill. ["Hard Rock Casino" by Ted Murphy/Flickr is licensed under CC BY 2.0.]

It may be that pathological gamblers' brains are different than those of other people, and perhaps this difference may somehow have led to their gambling addiction, as these studies seem to suggest. However, it is very difficult to ascertain the cause because it is impossible to conduct a true experiment (it would be unethical to try to turn randomly assigned participants into problem gamblers). Therefore, it may be that causation actually moves in the opposite direction—perhaps the act of gambling somehow changes neurotransmitter levels in some gamblers' brains. It also is possible that some overlooked factor, or confounding variable, played a role in both the gambling addiction and the differences in brain chemistry. ■

immediate reinforcement (Tolman & Honzik, 1930; Tolman et al., 1946). This finding was in conflict with the prevailing idea at the time that reinforcement must be immediate in order for learning to occur, thus suggesting a cognitive aspect to learning.

In the experiments, Tolman placed hungry rats in a maze with no reward for finding their way through it. He also studied a comparison group that was rewarded with food at the end of the maze. As the unreinforced rats explored the maze, they developed a **cognitive map**: a mental picture of the layout of the maze (**FIGURE 18.6**). After 10 sessions in the maze without reinforcement, food was placed in a goal box at the end of the maze. As soon as the rats became aware of the food, they were able to find their way through the maze quickly, just as quickly as the comparison group, which had been rewarded with food all along. This is known as **latent learning**: learning that occurs but is not observable in behavior until there is a reason to demonstrate it.

Latent learning also occurs in humans. Children may learn by watching the actions of their parents but only demonstrate it at a later date, when the learned material is needed. For example, suppose that Ravi's dad drives him to school every day. In this way, Ravi learns the route from his house to his school, but he's never driven there himself, so he has not had a chance to demonstrate that he's learned the way. One morning Ravi's dad has to leave early for a meeting, so he can't drive Ravi to school. Instead, Ravi follows the same route on his bike that his dad would have taken in the car. This demonstrates latent learning. Ravi had learned the route to school, but had no need to demonstrate this knowledge earlier.

LINK TO LEARNING

Watch this video to learn more about Carlson's studies on cognitive maps and navigation in buildings.

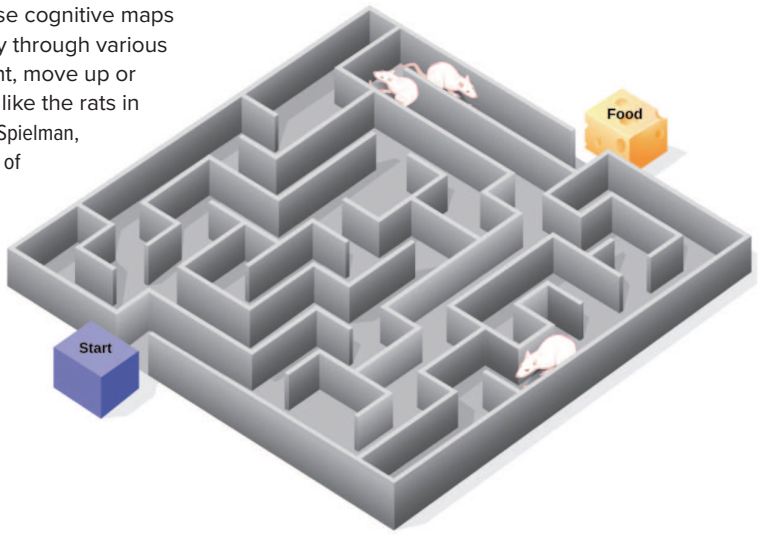

FIGURE 18.6. Psychologist Edward Tolman found that rats use cognitive maps to navigate through a maze. Have you ever worked your way through various levels on a video game? You learned when to turn left or right, move up or down. In that case you were relying on a cognitive map, just like the rats in a maze. [This work, "Rats and cognitive maps and maze," by Rose M. Spielman, PhD/Wikimedia Commons is licensed under CC BY 4.0. It is a derivative of "Maze Puzzle (Blender)" by FutUndBeidl/Flickr, which is licensed under CC BY 2.0.]

EVERYDAY CONNECTION

This Place Is Like a Maze

Have you ever gotten lost in a building and couldn't find your way back out? While that can be frustrating, you're not alone. At one time or another we've all gotten lost in places like a museum, hospital, or university library. Whenever we go someplace new, we build a mental representation—or cognitive map—of the location, as Tolman's rats built a cognitive map of their maze. However, some buildings are confusing because they include many areas that look alike or have short lines of sight. Because of this, it's often difficult to predict what's around a corner or decide whether to turn left or right to get out of a building. Psychologist Laura Carlson (2010) suggests that what we place in our cognitive map can impact our success in navigating through the environment. She suggests that paying attention to specific features upon entering a building, such as a picture on the wall, a fountain, a statue, or an escalator, adds information to our cognitive map that can be used later to help find our way out of the building. ■

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READING 19

Memories as Types and Stages

SOURCE

University of Minnesota. (2015). *Introduction to psychology.* University of Minnesota Libraries Publishing.
https://open.lib.umn.edu/intropsyc/

LEARNING OBJECTIVES

- Compare and contrast explicit and implicit memory, identifying the features that define each.
- Explain the function and duration of eidetic and echoic memories.
- Summarize the capacities of short-term memory and explain how working memory is used to process information in it.

KEY TERMS

chunking
echoic memory
episodic memory
explicit memory
iconic memory
implicit memory
long-term memory (LTM)
maintenance rehearsal
priming
procedural memory
recall memory test
recognition memory test
relearning
semantic memory
sensory memory
short-term memory (STM)
working memory

As you can see in **TABLE 19.1**, psychologists conceptualize memory in terms of *types*, *stages*, and *processes*. In this section we will consider the two types of memory, *explicit memory* and *implicit memory*, and then the three major memory stages: *sensory*, *short-term*, and *long-term* (Atkinson & Shiffrin, 1968). Then, in the next section, we will consider the nature of long-term memory, with a particular emphasis on the cognitive techniques we can use to improve our memories. Our discussion will focus on the three processes that are central to long-term memory: *encoding*, *storage*, and *retrieval*.

TABLE 19.1. Memory Conceptualized in Terms of Types, Stages, and Processes

As types	Explicit memory Implicit memory
As stages	Sensory memory Short-term memory Long-term memory
As processes	Encoding Storage Retrieval

EXPLICIT MEMORY

When we assess memory by asking a person to consciously remember things, we are measuring *explicit memory*. **Explicit memory** refers to knowledge or experiences that can be consciously remembered. As you can see in **FIGURE 19.1**, there are two types of explicit memory: *episodic* and *semantic*. **Episodic memory** refers to the firsthand experiences that we have had (e.g., recollections of our high school graduation day or of the fantastic dinner we had in New York last year). **Semantic memory** refers to our knowledge of facts and concepts about the world (e.g., that the absolute value of −90 is

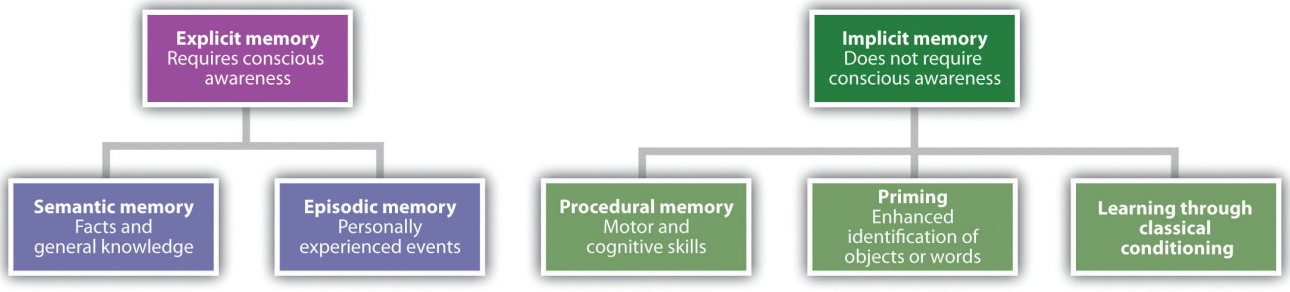

FIGURE 19.1. Types of memory. ["Types of Memory" by University of Minnesota is licensed under CC BY-NC-SA 4.0.]

greater than the absolute value of 9 and that one definition of the word "affect" is "the experience of feeling or emotion").

Explicit memory is assessed using measures in which the individual being tested must consciously attempt to remember the information. A **recall memory test** is a measure of explicit memory that involves bringing from memory information that has previously been remembered. We rely on our recall memory when we take an essay test, because the test requires us to generate previously remembered information. A multiple-choice test is an example of a **recognition memory test**, a measure of explicit memory that involves determining whether information has been seen or learned before.

Your own experiences taking tests will probably lead you to agree with the scientific research finding that recall is more difficult than recognition. Recall, such as required on essay tests, involves two steps: first generating an answer and then determining whether it seems to be the correct one. Recognition, as on multiple-choice tests, only involves determining which item from a list seems most correct (Haist et al., 1992). Although they involve different processes, recall and recognition memory measures tend to be correlated. Students who do better on a multiple-choice exam will also, by and large, do better on an essay exam (Bridgeman & Morgan, 1996).

A third way of measuring memory is known as relearning (Nelson, 1985). Measures of **relearning** (or savings) assess how much more quickly information is processed or learned when it is studied again after it has already been learned but then forgotten. If you have taken some French courses in the past, for instance, you might have forgotten most of the vocabulary you learned. But if you were to work on your French again, you'd learn the vocabulary much faster the second time around. Relearning can be a more sensitive measure of memory than either recall or recognition because it allows assessing memory in terms of "how much" or "how fast" rather than simply "correct" versus "incorrect" responses. Relearning also allows us to measure memory for procedures like driving a car or playing a piano piece, as well as memory for facts and figures.

IMPLICIT MEMORY

While explicit memory consists of the things that we can consciously report that we know, implicit memory refers to knowledge that we cannot consciously access. However, implicit memory is nevertheless exceedingly important to us because it has a direct effect on our behavior. **Implicit memory** refers to the influence of experience on behavior, even if the individual is not aware of those influences. As you can see in FIGURE 19.1, there are three general types of implicit memory: procedural memory, classical conditioning effects, and priming.

Procedural memory refers to our often unexplainable knowledge of how to do things. When we walk from one place to another, speak to another person in English, dial a cell phone, or play a video game, we are using procedural memory. Procedural memory allows us to perform complex tasks, even though we may not be able to explain to others how we do them. There is no way to tell someone how to ride a bicycle; a person has to learn by doing it. The idea of implicit memory helps explain how infants are able to learn. The ability to crawl, walk, and talk are procedures, and these skills are easily and efficiently developed while we are children despite the fact that as adults we have no conscious memory of having learned them.

A second type of implicit memory is classical conditioning effects, in which we learn, often without effort or awareness, to associate neutral stimuli (such as a sound or a light) with another stimulus (such as food), which creates a naturally occurring response, such as enjoyment or salivation. The memory for the association is demonstrated when the conditioned stimulus (the sound) begins to create the same response as the unconditioned stimulus (the food) did before the learning.

The final type of implicit memory is known as **priming**, or changes in behavior as a result of experiences that have happened frequently or recently. Priming refers both to the activation of knowledge (e.g., we can prime the concept of "kindness" by presenting people with words related to kindness) and to the influence of that activation on behavior (people who are primed with the concept of kindness may act more kindly).

One measure of the influence of priming on implicit memory is the *word fragment test*, in which a person is asked to fill in missing letters to make words. You can try this yourself: First, try to complete the following word fragments, but work on each one for only three or four seconds. Do any words pop into mind quickly?

_ i b _ a _ y
_ h _ s _ _ i _ n
_ o _ k
_ h _ i s _

Now read the following sentence carefully:

> "He got his materials from the shelves, checked them out, and then left the building."

Then try again to make words out of the word fragments.

I think you might find that it is easier to complete fragments 1 and 3 as "library" and "book," respectively, after you read the sentence than it was before you read it. However, reading the sentence didn't really help you to complete fragments 2 and 4 as "physician" and "chaise." This difference in implicit memory probably occurred because as you read the sentence, the concept of "library" (and perhaps "book") was primed, even though they were never mentioned explicitly. Once a concept is primed it influences our behaviors, for instance, on word fragment tests.

RESEARCH FOCUS

Priming Outside Awareness Influences Behavior

One of the most important characteristics of implicit memories is that they are frequently formed and used *automatically*, without much effort or awareness on our part. In one demonstration of the automaticity and influence of priming effects, John Bargh and his colleagues (1996) conducted a study in which they showed college students lists of five scrambled words, each of which they were to make into a sentence. Furthermore, for half of the research participants, the words were related to stereotypes of the elderly. These participants saw words such as the following:

in Florida retired live people
bingo man the forgetful plays

The other half of the research participants also made sentences, but from words that had nothing to do with elderly stereotypes. The purpose of this task was to prime stereotypes of elderly people in memory for some of the participants but not for others.

The experimenters then assessed whether the priming of elderly stereotypes would have any effect on the students' behavior—and indeed it did. When the research participant had gathered all of his or her belongings, thinking that the experiment was over, the experimenter thanked him or her for participating and gave directions to the closest elevator. Then, without the participants knowing it, the experimenters recorded the amount of time that the participant spent walking from the doorway of the experimental room toward the elevator. As you can see in **FIGURE 19.2**, participants who had made sentences using words related to elderly stereotypes took on the behaviors of the elderly—they walked significantly more slowly as they left the experimental room.

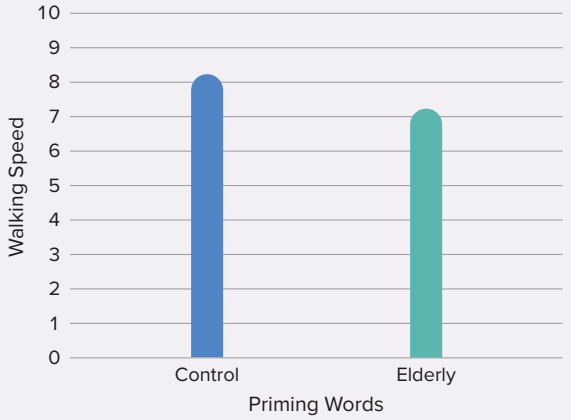

FIGURE 19.2. Bargh, Chen, and Burrows (1996) found that priming words associated with the elderly made people walk more slowly. ["Walking Speed and Priming Words" by Judy Schmitt is licensed under CC BY-NC-SA 4.0. Adapted from Bargh et al. (1996)].

To determine if these priming effects occurred out of the awareness of the participants, Bargh and his colleagues asked yet another group of students to complete the priming task and then to indicate whether they thought the words they had used to make the sentences had any relationship to each other, or could possibly have influenced their behavior in any way. These students had no awareness of the possibility that the words might have been related to the elderly or could have influenced their behavior. ■

Our everyday behaviors are influenced by priming in a wide variety of situations. Seeing an advertisement for cigarettes may make us start smoking, seeing the flag of our home country may arouse our patriotism, and seeing a student from a rival school may arouse our competitive spirit. And these influences on our behaviors may occur without our being aware of them.

STAGES OF MEMORY: SENSORY, SHORT-TERM, AND LONG-TERM MEMORY

Another way of understanding memory is to think about it in terms of stages that describe the length of time that information remains available to us. According to this approach (see **FIGURE 19.3**), information begins in *sensory memory*, moves to *short-term memory*, and eventually moves to *long-term memory*. But not all information makes it through all three stages; most of it is forgotten. Whether the information moves from shorter-duration memory into longer-duration memory or whether it is lost from memory entirely depends on how the information is attended to and processed.

Sensory Memory

Sensory memory refers to the brief storage of sensory information. Sensory memory is a memory buffer that lasts only very briefly and then, unless it is attended to and passed on for more processing, is forgotten. The purpose of sensory memory is to give the brain some time to process the incoming sensations and to allow us to see the world as an unbroken stream of events rather than as individual pieces.

Visual sensory memory is known as **iconic memory**. Iconic memory was first studied by the psychologist George Sperling (1960). In his research, Sperling showed participants a display of letters in rows, similar to that shown in **FIGURE 19.4**. However, the display lasted only about 50 milliseconds (one-twentieth of a second). Then, Sperling gave his participants a recall test in which they were asked to name all the letters they could remember. On average, the participants could remember only about one-quarter of the letters they had seen.

Sperling reasoned that the participants had seen all the letters but could remember them only very briefly, making it impossible for them to report them all. To test this idea,

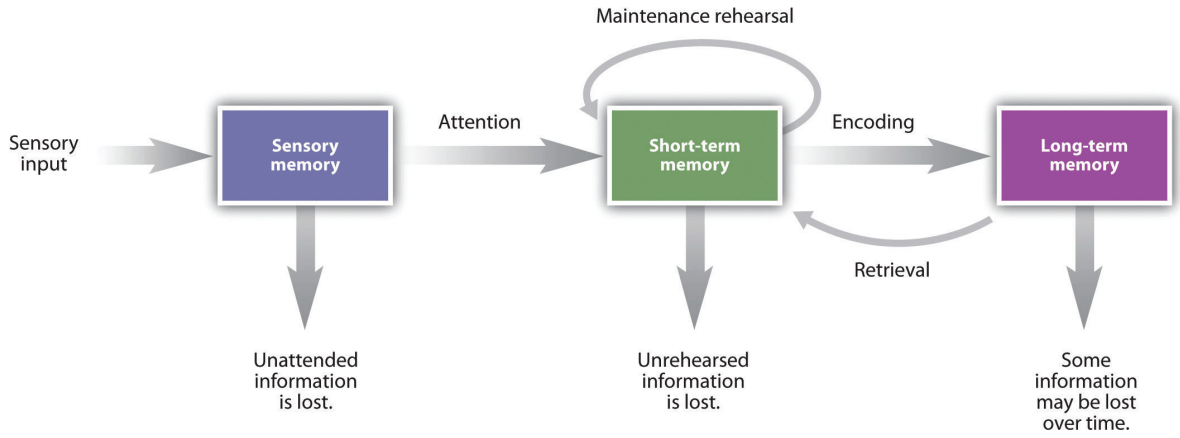

FIGURE 19.3. Memory duration. Memory can be characterized in terms of stages—the length of time that information remains available to us. ["Memory Duration" by University of Minnesota is licensed under CC BY-NC-SA 4.0. Adapted from Atkinson and Shiffrin (1968).]

in his next experiment he first showed the same letters, but then *after the display had been removed*, he signaled to the participants to report the letters from either the first, second, or third row. In this condition, the participants now reported almost all the letters in that row. This finding confirmed Sperling's hunch: Participants had access to all of the letters in their iconic memories, and if the task was short enough, they were able to report on the part of the display he asked them to. The "short enough" is the length of iconic memory, which turns out to be about 250 milliseconds (¼ of a second).

Auditory sensory memory is known as **echoic memory**. In contrast to iconic memories, which decay very rapidly, echoic memories can last as long as 4 seconds (Cowan et al., 1990). This is convenient as it allows you—among other things—to remember the words that you said at the beginning of a long sentence when you get to the end of it, and to take notes on your psychology professor's most recent statement even after he or she has finished saying it.

In some people iconic memory seems to last longer, a phenomenon known as *eidetic imagery* (or "photographic memory") in which people can report details of an image over long periods of time. These people, who often suffer from psychological disorders such as autism, claim that they can "see" an image long after it has been presented, and can often report accurately on that image. There is also some evidence for eidetic memories in hearing; some people report that their echoic memories persist for unusually long periods of time. The composer Wolfgang Amadeus Mozart may have possessed eidetic memory for music, because even when he was very young and had not yet had a great deal of musical training, he could listen to long compositions and then play them back almost perfectly (Solomon, 1995).

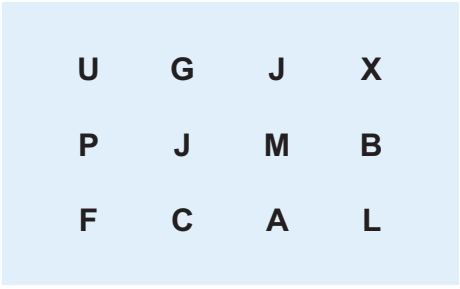

FIGURE 19.4. Measuring iconic memory. Sperling (1960) showed his participants displays such as this one for only one-twentieth of a second. He found that when he cued the participants to report one of the three rows of letters, they could do it, even if the cue was given shortly after the display had been removed. The research demonstrated the existence of iconic memory. ["Measuring Iconic Memory" by Judy Schmitt is licensed under CC BY-NC-SA 4.0. Adapted from Sperling (1960).]

Short-Term Memory

Most of the information that gets into sensory memory is forgotten, but information that we turn our attention to, with the goal of remembering it, may pass into *short-term memory*. **Short-term memory (STM)** is the place where small amounts of information can be temporarily kept for more than a few seconds but usually for less than one minute (Baddeley et al., 1990). Information in short-term memory is not stored permanently but rather becomes available for us to process, and the processes that we use to make sense of, modify, interpret, and store information in STM are known as **working memory**.

Although it is called "memory," working memory is not a store of memory like STM but rather a set of memory procedures or operations. Imagine, for instance, that you are asked to participate in a task such as this one, which is a measure of working memory (Unsworth & Engle, 2007). Each of

the following questions appears individually on a computer screen and then disappears after you answer the question:

Is 10 × 2 − 5 = 15?	(Answer YES or NO)	Then remember "S"
Is 12 ÷ 6 − 2 = 1?	(Answer YES or NO)	Then remember "R"
Is 10 × 2 = 5?	(Answer YES or NO)	Then remember "P"
Is 8 ÷ 2 − 1 = 1?	(Answer YES or NO)	Then remember "T"
Is 6 × 2 − 1 = 8?	(Answer YES or NO)	Then remember "U"
Is 2 × 3 − 3 = 0?	(Answer YES or NO)	Then remember "Q"

To successfully accomplish the task, you have to answer each of the math problems correctly and at the same time remember the letter that follows the task. Then, after the six questions, you must list the letters that appeared in each of the trials in the correct order (in this case S, R, P, T, U, Q).

To accomplish this difficult task you need to use a variety of skills. You clearly need to use STM, as you must keep the letters in storage until you are asked to list them. But you also need a way to make the best use of your available attention and processing. For instance, you might decide to use a strategy of "repeat the letters twice, then quickly solve the next problem, and then repeat the letters twice again including the new one." Keeping this strategy (or others like it) going is the role of working memory's *central executive*—the part of working memory that directs attention and processing. The central executive will make use of whatever strategies seem to be best for the given task. For instance, the central executive will direct the rehearsal process, and at the same time direct the visual cortex to form an image of the list of letters in memory. You can see that although STM is involved, the processes that we use to operate on the material in memory are also critical.

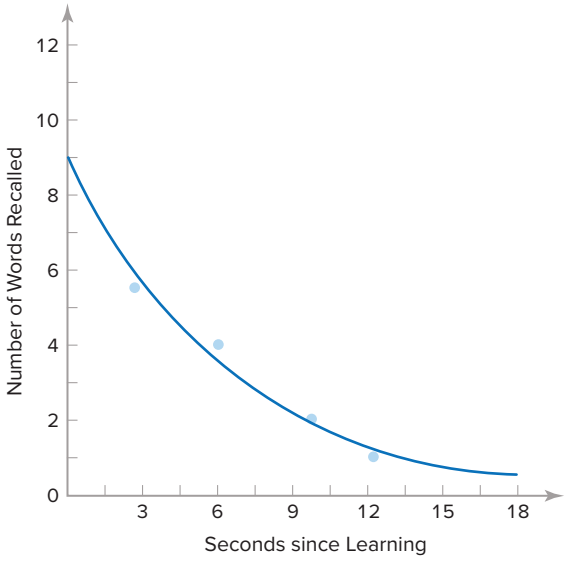

FIGURE 19.5. Short-term memory decay. Peterson and Peterson (1959) found that information that was not rehearsed decayed quickly from memory. ["STM Decay" by Judy Schmitt is licensed under CC BY-NC-SA 4.0. Adapted from Peterson and Peterson (1959).]

Short-term memory is limited in both the length and the amount of information it can hold. Peterson and Peterson (1959) found that when people were asked to remember a list of three-letter strings and then were immediately asked to perform a distracting task (counting backward by threes), the material was quickly forgotten (see **FIGURE 19.5**), such that by 18 seconds it was virtually gone.

One way to prevent the decay of information from short-term memory is to use working memory to rehearse it. **Maintenance rehearsal** is the process of repeating information mentally or out loud with the goal of keeping it in memory. We engage in maintenance rehearsal to keep something that we want to remember (e.g., a person's name, e-mail address, or phone number) in mind long enough to write it down, use it, or potentially transfer it to long-term memory.

If we continue to rehearse information it will stay in STM until we stop rehearsing it, but there is also a capacity limit to STM. Try reading each of the following rows of numbers, one row at a time, at a rate of about one number each second. Then when you have finished each row, close your eyes and write down as many of the numbers as you can remember.

019
3586
10295
861059
1029384
75674834
657874104
6550423897

If you are like the average person, you will have found that on this test of working memory, known as a *digit span test*, you did pretty well up to about the fourth line, and then you started having trouble. I bet you missed some of the numbers in the last three rows, and did pretty poorly on the last one.

The digit span of most adults is between five and nine digits, with an average of about seven. The cognitive psychologist George Miller (1956) referred to "seven plus or minus two" pieces of information as the "magic number" in short-term memory. But if we can only hold a maximum of about nine digits in short-term memory, then how can we remember larger amounts of information than this? For instance, how can we ever remember a 10-digit phone number long enough to dial it?

One way we are able to expand our ability to remember things in STM is by using a memory technique called chunking. **Chunking** is the process of organizing information into smaller groupings (chunks), thereby increasing the number of items that can be held in STM. For instance, try to remember this string of 12 letters:

XOFCBANNCVTM

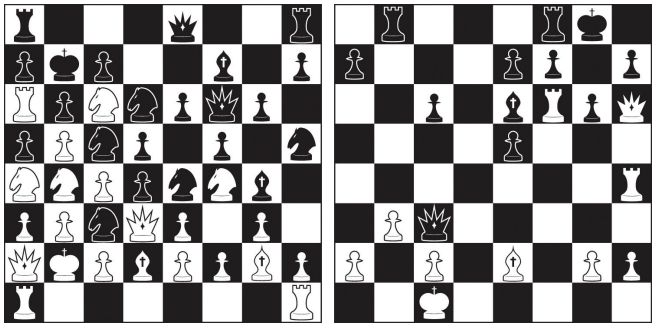

FIGURE 19.6. Impossible (left) and possible (right) chess positions. Experience matters: Experienced chess players are able to recall the positions of the game on the right much better than are those who are chess novices. But the experts do no better than the novices in remembering the positions on the left, which cannot occur in a real game. ["Impossible and Possible Chess Positions" by University of Minnesota is licensed under CC BY-NC-SA 4.0.]

You probably won't do that well because the number of letters is more than the magic number of seven. Now try again with this one:

MTVCNNABCFOX

Would it help you if I pointed out that the material in this string could be chunked into four sets of three letters each? I think it would, because then rather than remembering 12 letters, you would only have to remember the names of four television stations. In this case, chunking changes the number of items you have to remember from 12 to only four.

Experts rely on chunking to help them process complex information. Herbert Simon and William Chase (1973) showed chess masters and chess novices various positions of pieces on a chessboard for a few seconds each. The experts did a lot better than the novices in remembering the positions because they were able to see the "big picture." They didn't have to remember the position of each of the pieces individually, but chunked the pieces into several larger layouts. But when the researchers showed both groups random chess positions—positions that would be very unlikely to occur in real games—both groups did equally poorly, because in this situation the experts lost their ability to organize the layouts (see **FIGURE 19.6**). The same occurs for basketball. Basketball players recall actual basketball positions much better than do nonplayers, but only when the positions make sense in terms of what is happening on the court, or what is likely to happen in the near future, and thus can be chunked into bigger units (Didierjean & Marmèche, 2005).

Long-Term Memory

If information makes it past short term-memory it may enter **long-term memory (LTM)**, memory storage that can hold information for days, months, and years. The capacity of long-term memory is large, and there is no known limit to what we can remember (Wang et al., 2003). Although we may forget at least some information after we learn it, other things will stay with us forever. In the next section we will discuss the principles of long-term memory.

KEY TAKEAWAYS

- Memory refers to the ability to store and retrieve information over time.
- For some things our memory is very good, but our active cognitive processing of information assures that memory is never an exact replica of what we have experienced.
- Explicit memory refers to experiences that can be intentionally and consciously remembered, and it is measured using recall, recognition, and relearning. Explicit memory includes episodic and semantic memories.
- Measures of relearning (also known as savings) assess how much more quickly information is learned when it is studied again after it has already been learned but then forgotten.
- Implicit memory refers to the influence of experience on behavior, even if the individual is not aware of those influences. The three types of implicit memory are procedural memory, classical conditioning, and priming.
- Information processing begins in sensory memory, moves to short-term memory, and eventually moves to long-term memory.
- Maintenance rehearsal and chunking are used to keep information in short-term memory.
- The capacity of long-term memory is large, and there is no known limit to what we can remember.

EXERCISES AND CRITICAL THINKING

1. List some situations in which sensory memory is useful for you. What do you think your experience of the stimuli would be like if you had no sensory memory?
2. Describe a situation in which you need to use working memory to perform a task or solve a problem. How do your working memory skills help you?

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READING 20

How We Remember: Cues to Improving Memory

SOURCE

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LEARNING OBJECTIVES

- Label and review the principles of encoding, storage, and retrieval.
- Summarize the types of amnesia and their effects on memory.
- Describe how the context in which we learn information can influence our memory of that information.

KEY TERMS

amnesia
anterograde amnesia
categories
context-dependent learning
elaborative encoding
long-term potentiation (LTP)
primacy effect
proactive interference
prototype
recency effect
retrieval
retroactive interference
retrograde amnesia
schemas
spacing effect
state-dependent learning
tip-of-the-tongue phenomenon

Although it is useful to hold information in sensory and short-term memory, we also rely on our long-term memory (LTM). We want to remember the name of the new boy in the class, the name of the movie we saw last week, and the material for our upcoming psychology test. Psychological research has produced a great deal of knowledge about long-term memory, and this research can be useful as you try to learn and remember new material (see **TABLE 20.1**). In this

TABLE 20.1. Helpful Memory Techniques Based on Psychological Research

Technique	Description	Useful example
Use elaborative encoding.	Material is better remembered if it is processed more fully.	Think, for instance, "Proactive interference is like retroactive interference but it occurs in a forward manner."
Make use of the self-reference effect.	Material is better remembered if it is linked to thoughts about the self.	Think, for instance, "I remember a time when I knew the answer to an exam question but couldn't quite get it to come to mind. This was an example of the tip-of-the-tongue phenomenon."
Be aware of the forgetting curve.	Information that we have learned drops off rapidly with time.	Review the material that you have already studied right before the exam to increase the likelihood it will remain in memory.
Make use of the spacing effect.	Information is learned better when it is studied in shorter periods spaced over time.	Study a little bit every day; do not cram at the last minute.
Rely on overlearning.	We can continue to learn even after we think we know the information perfectly.	Keep studying, even if you think you already have it down.
Use context-dependent retrieval.	We have better retrieval when it occurs in the same situation in which we learned the material.	If possible, study under conditions similar to the conditions in which you will take the exam.
Use state-dependent retrieval.	We have better retrieval when we are in the same psychological state as we were when we learned the material.	Many possibilities, but don't study under the influence of drugs or alcohol, unless you plan to use them on the day of the exam (which is not recommended).

section we will consider this question in terms of the types of processing that we do on the information we want to remember. To be successful, the information that we want to remember must be *encoded* and *stored*, and then *retrieved*.

ENCODING AND STORAGE: HOW OUR PERCEPTIONS BECOME MEMORIES

Encoding is the process by which we place the things that we experience into memory. Unless information is encoded, it cannot be remembered. I'm sure you've been to a party where you've been introduced to someone and then—maybe only seconds later—you realize that you do not remember the person's name. Of course it's not really surprising that you can't remember the name, because you probably were distracted and you never encoded the name to begin with.

Not everything we experience can or should be encoded. We tend to encode things that we need to remember and not bother to encode things that are irrelevant. Look at **FIGURE 20.1**, which shows different images of U.S. pennies. Can you tell which one is the real one? Nickerson and Adams (1979) found that very few of the U.S. participants they tested could identify the right one. We see pennies a lot, but we don't bother to encode their features.

One way to improve our memory is to use better encoding strategies. Some ways of studying are more effective than others. Research has found that we are better able to remember information if we encode it in a meaningful way. When we engage in **elaborative encoding** we process new information in ways that make it more relevant or meaningful (Craik & Lockhart, 1972; Harris & Qualls, 2000).

Imagine that you are trying to remember the characteristics of the different schools of psychology. Rather than simply trying to remember the schools and their characteristics, you might try to relate the information to things you already know. For instance, you might try to remember the fundamentals of the cognitive school of psychology by linking the characteristics to the computer model. The cognitive school focuses on how information is input, processed, and retrieved, and you might think about how computers do pretty much the same thing. You might also try to organize the information into meaningful units. For instance, you might link the cognitive school to structuralism because both were concerned with mental processes. You also might try to use visual cues to help you remember the information. You might look at the image of Freud and imagine what he looked like as a child. That image might help you remember that childhood experiences were an important part of Freudian theory. Each person has his or her unique way of elaborating on information; the important thing is to try to develop unique and meaningful associations among the materials.

Using the Contributions of Hermann Ebbinghaus to Improve Your Memory

Hermann Ebbinghaus (1850–1909) was a pioneer of the study of memory. In this section we consider three of his most

FIGURE 20.1. Pennies in different styles. Can you identify the "real" penny? We tend to have poor memory for things that don't matter, even if we see them frequently. ["Pennies in Different Styles" by University of Minnesota is licensed under CC BY-NC-SA 4.0.]

RESEARCH FOCUS

Elaboration and Memory

In an important study showing the effectiveness of elaborative encoding, Rogers et al. (1977) studied how people recalled information that they had learned under different processing conditions. All the participants were presented with the same list of 40 adjectives to learn, but through the use of random assignment, the participants were given one of four different sets of instructions about how to process the adjectives.

Participants assigned to the *structural task condition* were asked to judge whether the word was printed in uppercase or lowercase letters. Participants in the *phonemic task condition* were asked whether or not the word rhymed with another given word. In the *semantic task condition*, the participants were asked if the word was a synonym of another word. And in the *self-reference task condition*, participants were asked to indicate whether or not the given adjective was or was not true of themselves. After completing the specified task, each participant was asked to recall as many adjectives as he or she could remember.

Rogers and his colleagues hypothesized that different types of processing would have different effects on memory. As you can see in **FIGURE 20.2**, the students in the self-reference task condition recalled significantly more adjectives than did students in any other condition. This finding, known as the *self-reference effect*, is powerful evidence that the self-concept helps us organize and remember information. The next time you are studying for an exam, you might try relating the material to your own experiences. The self-reference effect suggests that doing so will help you better remember the information (Symons & Johnson, 1997). ■

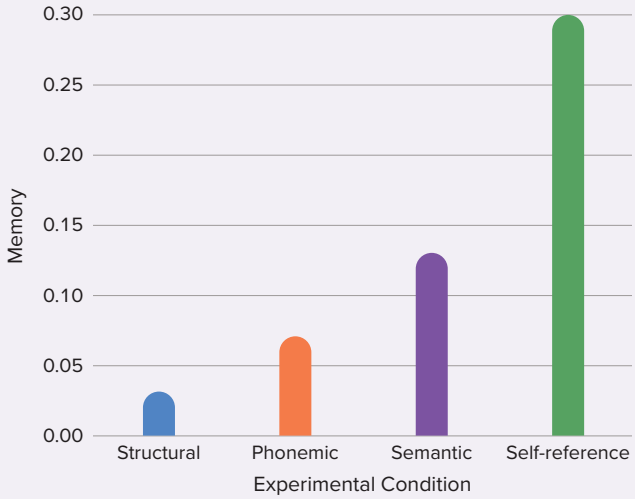

FIGURE 20.2. Self-reference effect results. Participants recalled the same words significantly better when they were processed in relation to the self than when they were processed in other ways. ["Memory and Experimental Condition" by Judy Schmitt is licensed under CC BY-NC-SA 4.0. Adapted from Rogers et al. (1977).]

important findings, each of which can help you improve your memory. In his research, in which he was the only research participant, Ebbinghaus practiced memorizing lists of nonsense syllables, such as the following:

DIF, LAJ, LEQ, MUV, WYC, DAL, SEN, KEP, NUD

You can imagine that because the material he was trying to learn was not at all meaningful, it was not easy to do. Ebbinghaus plotted how many of the syllables he could remember against the time that had elapsed since he had studied them. He discovered an important principle of memory: Memory decays rapidly at first, but the amount of decay levels off with time (**FIGURE 20.3**). Although Ebbinghaus looked at forgetting after days had elapsed, the same effect occurs on longer and shorter time scales. Bahrick (1984) found that students who took a Spanish language course forgot about half of the vocabulary they had learned within three years, but that after that time their memory remained pretty much constant. Forgetting also drops off quickly on a shorter time frame. This suggests that you should try to review the material that you have already studied right before you take an exam; that way, you will be more likely to remember the material during the exam.

Ebbinghaus also discovered another important principle of learning, known as the spacing effect. The **spacing effect** refers to the fact that learning is improved when the same amount of study is spread out over periods of time than it is when it occurs closer together or at the same time. This means that even if you have only a limited amount of time to study, you'll learn more if you study continually throughout the semester (a little bit every day is best) than if you wait to cram at the last minute before your exam (**FIGURE 20.4**). Another good strategy is to study and then wait as long as you can before you forget the material. Then review the information and again wait as long as you can before you forget it. (This probably will be a longer period of time than the first time.) Repeat and repeat again. The spacing effect is usually considered in terms of the difference between distributed practice (practice that is spread out over time) and massed practice (practice that comes in one block), with the former approach producing better memory.

Ebbinghaus also considered the role of *overlearning*—that is, continuing to practice and study even when we think that we have mastered the material. Ebbinghaus and other researchers have found that overlearning helps encoding

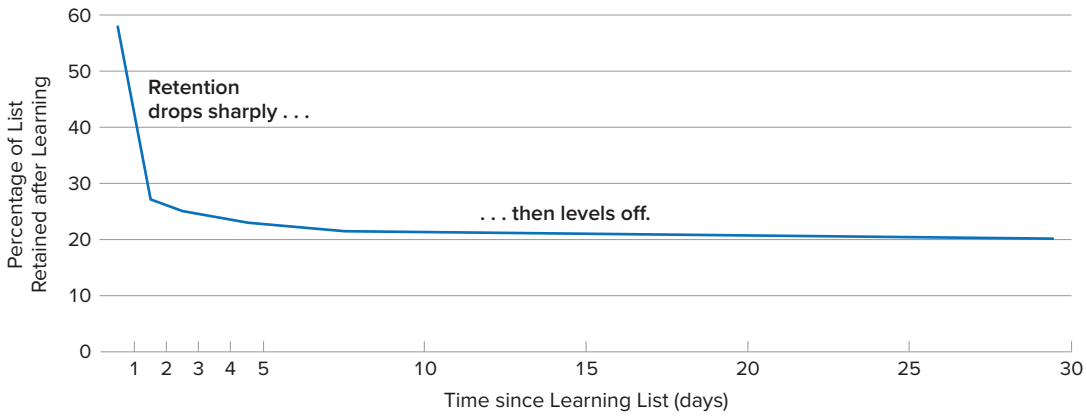

FIGURE 20.3. Ebbinghaus forgetting curve. Hermann Ebbinghaus found that memory for information drops off rapidly at first but then levels off after time. [This work, "Forgetting Curve," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Ebbinghaus Forgetting Curve" by University of Minnesota, which is licensed under CC BY-NC-SA 4.0.]

(Driskell et al., 1992). Students frequently think that they have already mastered the material but then discover when they get to the exam that they have not. The point is clear: Try to keep studying and reviewing, even if you think you already know all the material.

RETRIEVAL

Even when information has been adequately encoded and stored, it does not do us any good if we cannot retrieve it. **Retrieval** refers to the process of reactivating information that has been stored in memory. You can get an idea of the difficulty posed by retrieval by simply reading to someone each of the words (but not the categories) in the Retrieval Demonstration. Tell the person that after you have read all the words, you will ask her to recall the words.

After you read the list to your friend, give her enough time to write down all the words she can recall. Make sure that she cannot recall any more and then, for the words that were not listed, prompt your friend with some of the category names: "Do you remember any words that were furniture? Do you remember any words that were tools?" I think you will find that the category names, which serve as retrieval cues, will help your friend remember information that she could not retrieve otherwise.

RETRIEVAL DEMONSTRATION

Try this test of the ability to retrieve information with a classmate. The instructions are in the text.

Apple	(Fruit)
Dresser	(Furniture)
Sander	(Tool)
Pomegranate	(Fruit)
Sunflower	(Flower)
Tangerine	(Fruit)
Chair	(Furniture)
Peony	(Flower)
Banana	(Fruit)
Sofa	(Furniture)
Bench	(Furniture)
Strawberry	(Fruit)
Television stand	(Furniture)
Magnolia	(Flower)
Rose	(Flower)
Wrench	(Tool)
Screwdriver	(Tool)
Dahlia	(Flower)
Drill press	(Tool)
Hammer	(Tool)

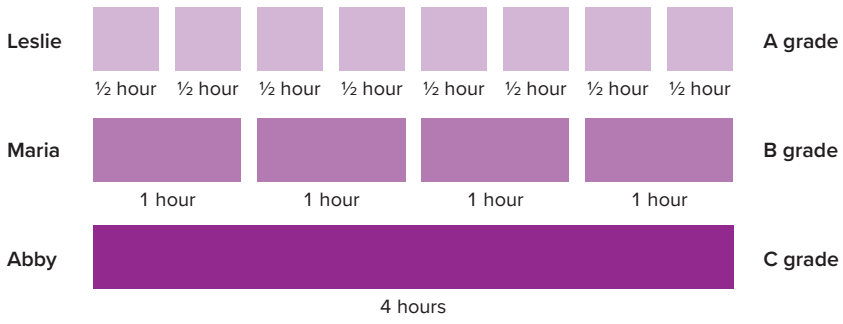

FIGURE 20.4. Effects of massed versus distributed practice on learning. The spacing effect refers to the fact that memory is better when it is *distributed* rather than *massed*. Leslie, Maria, and Abby all studied for four hours total, but the students who spread out their learning into smaller study sessions did better on the exam. ["Massed vs Distributed Practice" by Judy Schmitt is licensed under CC BY-NC-SA 4.0.]

We've all experienced retrieval failure in the form of the frustrating **tip-of-the-tongue phenomenon**, in which we are certain that we know something we are trying to recall but cannot quite come up with it. You can try this one on your friends as well. Read your friend the names of the 10 states listed in the States and Capital Cities Demonstration, and ask him to name the capital city of each state. Now, for the capital cities that your friend can't name, give him just the first letter of the capital city. You'll probably find that having the first letters of the cities helps with retrieval. The tip-of-the-tongue experience is a very good example of the inability to retrieve information that is actually stored in memory.

STATES AND CAPITAL CITIES DEMONSTRATION

Try this demonstration of the tip-of-the-tongue phenomenon with a classmate. Instructions are in the text.

Georgia	(Atlanta)
Maryland	(Annapolis)
California	(Sacramento)
Louisiana	(Baton Rouge)
Florida	(Tallahassee)
Colorado	(Denver)
New Jersey	(Trenton)
Arizona	(Phoenix)
Nebraska	(Lincoln)
Kentucky	(Frankfort)

We are more likely to be able to retrieve items from memory when conditions at retrieval are similar to the conditions under which we encoded them. **Context-dependent learning** refers to an increase in retrieval when the external situation in which information is learned matches the situation in which it is remembered. Godden and Baddeley (1975) conducted a study to test this idea using scuba divers. They asked the divers to learn a list of words either when they were on land or when they were underwater. Then they tested the divers on their memory, either in the same or the opposite situation. As you can see in **FIGURE 20.5**, the divers' memory was better when they were tested in the same context in which they had learned the words than when they were tested in the other context.

You can see that context-dependent learning might also be important in improving your memory. For instance, you might want to try to study for an exam in a situation that is similar to the one in which you are going to take the exam.

Whereas context-dependent learning refers to a match in the external situation between learning and remembering, **state-dependent learning** refers to superior retrieval of memories when the individual is in the same physiological or psychological state as during encoding. Research has found, for instance, that animals that learn a maze while under the influence of one drug tend to remember their learning

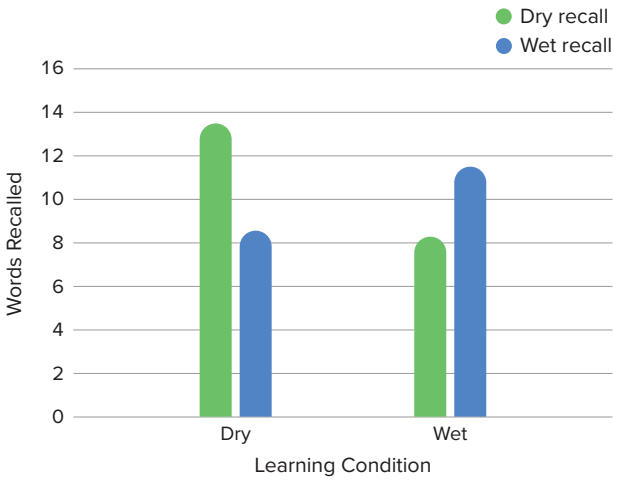

FIGURE 20.5. Godden and Baddeley (1975) tested the memory of scuba divers to learn and retrieve information in different contexts and found strong evidence for context-dependent learning. ["Learning Condition and Recollection" by Judy Schmitt is licensed under CC BY-NC-SA 4.0. Adapted from Godden and Baddeley (1975).]

better when they are tested under the influence of the same drug than when they are tested without the drug (Jackson et al., 1992). And research with humans finds that bilinguals remember better when tested in the same language in which they learned the material (Marian & Kaushanskaya, 2007). Mood states may also produce state-dependent learning. People who learn information when they are in a bad (rather than a good) mood find it easier to recall these memories when they are tested while they are in a bad mood, and vice versa. It is easier to recall unpleasant memories than pleasant ones when we're sad, and easier to recall pleasant memories than unpleasant ones when we're happy (Bower, 1981; Eich, 2008).

Variations in the ability to retrieve information are also seen in the *serial position curve*. When we give people a list of words one at a time (e.g., on flashcards) and then ask them to recall them, the results look something like those in **FIGURE 20.6**. People are able to retrieve more words that were presented to them at the beginning and the end of the list than they are words that were presented in the middle of the list. This pattern, known as the serial position curve, is caused by two retrieval phenomena: The **primacy effect** refers to a tendency to better remember stimuli that are presented early in a list; the **recency effect** refers to the tendency to better remember stimuli that are presented later in a list.

There are a number of explanations for primacy and recency effects, but one of them is in terms of the effects of rehearsal on short-term and long-term memory (Baddeley et al., 2009). Because we can keep the last words we learned in the presented list in short-term memory by rehearsing them before the memory test begins, they are relatively easily remembered. So the recency effect can be explained in terms

FIGURE 20.6. The serial position curve is the result of both primacy effects and recency effects. [This work, "Serial Position Curve," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "The Serial Position Curve" by University of Minnesota, which is licensed under CC BY-NC-SA 4.0.]

of maintenance rehearsal in short-term memory. And the primacy effect may also be due to rehearsal—when we hear the first word in the list we start to rehearse it, making it more likely that it will be moved from short-term to long-term memory. And the same is true for the other words that come early in the list. But for the words in the middle of the list, this rehearsal becomes much harder, making them less likely to be moved to LTM.

In some cases our existing memories influence our new learning. This may occur either in a backward way or a forward way. **Retroactive interference** occurs when learning something new impairs our ability to retrieve information that was learned earlier. For example, if you have learned to program in one computer language, and then you learn to program in another similar one, you may start to make mistakes programming the first language that you never would have made before you learned the new one. In this case the new memories work backward (retroactively) to influence retrieval from memory that is already in place.

In contrast to retroactive interference, *proactive interference* works in a forward direction (see **TABLE 20.2** for a comparison). **Proactive interference** occurs when earlier learning impairs our ability to encode information that we try to learn later. For example, if we have learned French as a second language, this knowledge may make it more difficult, at least in some respects, to learn a third language (say Spanish), which involves similar but not identical vocabulary.

TABLE 20.2. Retroactive and Proactive Interference

Retroactive interference works backward and interferes with retrieval:

Learn Spanish	Learn French	Remember Spanish
One = *uno*	One = *une*	One = ?
Man = *hombre*	Man = *homme*	Man = ?
Cherry = *cereza*	Cherry = *cerise*	Cherry = ?

Proactive interference works forward and interferes with encoding:

Learn Spanish	Learn French
One = *uno*	One = *une? uno?*
Man = *hombre*	Man = *homme? hombre?*
Cherry = *cereza*	Cherry = *cerise? cereza?*

THE STRUCTURE OF LTM: CATEGORIES, PROTOTYPES, AND SCHEMAS

Memories that are stored in LTM are not isolated but rather are linked together into **categories**—networks of associated memories that have features in common with each other. Forming categories, and using categories to guide behavior, is a fundamental part of human nature. Associated concepts within a category are connected through *spreading activation*, which occurs when activating one element of a category activates other associated elements. For instance, because tools are associated in a category, reminding people of the word "screwdriver" will help them remember the word "wrench." And, when people have learned lists of words that come from different categories (e.g., as in the Retrieval Demonstration), they do not recall the information haphazardly. If they have just remembered the word "wrench," they are more likely to remember the word "screwdriver" next than they are to remember the word "dahlia," because the words are organized in memory by category and because "dahlia" is activated by spreading activation from "wrench" (Srull & Wyer, 1989).

Some categories have *defining features* that must be true of all members of the category. For instance, all members of the category "triangles" have three sides, and all members of

the category "birds" lay eggs. But most categories are not so well-defined; the members of the category share some common features, but it is impossible to define which are or are not members of the category. For instance, there is no clear definition of the category "tool." Some examples of the category, such as a hammer and a wrench, are clearly and easily identified as category members, whereas other members are not so obvious. Is an ironing board a tool? What about a car?

Members of categories (even those with defining features) can be compared to the category **prototype**, which is the member of the category that is most average or typical of the category (see FIGURE 20.7). Some category members are more prototypical of, or similar to, the category than others. For instance, some category members (robins and sparrows) are highly prototypical of the category "birds," whereas other category members (penguins and ostriches) are less prototypical. We retrieve information that is prototypical of a category faster than we retrieve information that is less prototypical (Rosch, 1975).

Mental categories are sometimes referred to as **schemas**—patterns of knowledge in long-term memory that help us organize information (see FIGURE 20.8). We have schemas about objects (that a triangle has three sides and may take on different angles), about people (that Sam is friendly, likes to golf, and always wears sandals), about events (the particular steps involved in ordering a meal at a restaurant), and about social groups (we call these group schemas *stereotypes*).

FIGURE 20.7. Prototypicality. Category members vary in terms of their prototypicality. Some cats are "better" members of the category than are others. [Clockwise from top left: "Lion - Linton Zoo" by Airwolfhound is licensed under CC BY-SA 2.0; "Sasha" by Kimli is licensed under CC BY-NC 2.0; "Sphinx" by Wei-Hang Chua is licensed under CC BY-NC-ND 2.0; "Beauty : Bon lundi et bonne semaine à tous!" by julicath/Cath is licensed under CC BY-NC-ND 2.0.]

FIGURE 20.8. Different schemas. Our schemas about people, couples, and events help us organize and remember information. ["smiling in Barcelona" by Gene Krasko is licensed under CC BY-NC-ND 2.0; "Couple" by David Shen is licensed under CC BY 2.0; "Lynne & Jérémie" by Shawn Harquail is licensed under CC BY-NC 2.0.]

Schemas are important in part because they help us remember new information by providing an organizational structure for it. Read the following paragraph (Bransford & Johnson, 1972) and then try to write down everything you can remember.

> The procedure is actually quite simple. First you arrange things into different groups. Of course, one pile may be sufficient depending on how much there is to do. If you have to go somewhere else due to lack of facilities, that is the next step; otherwise you are pretty well set. It is important not to overdo things. That is, it is better to do too few things at once than too many. In the short run this may not seem important, but complications can easily arise. A mistake can be expensive as well. At first the whole procedure will seem complicated. Soon, however, it will become just another facet of life. It is difficult to foresee any end to the necessity for this task in the immediate future, but then one never can tell. After the procedure is completed, one arranges the materials into different groups again. Then they can be put into their appropriate places. Eventually they will be used once more and the whole cycle will then have to be repeated. However, that is part of life.

It turns out that people's memory for this information is quite poor, unless they have been told ahead of time that the information describes "doing the laundry," in which case their memory for the material is much better. This demonstration of the role of schemas in memory shows how our existing knowledge can help us organize new information, and how this organization can improve encoding, storage, and retrieval.

THE BIOLOGY OF MEMORY

Just as information is stored on digital media such as DVDs and flash drives, the information in LTM must be stored in the brain. The ability to maintain information in LTM involves

a gradual strengthening of the connections among the neurons in the brain. When pathways in these neural networks are frequently and repeatedly fired, the synapses become more efficient in communicating with each other, and these changes create memory. This process, known as **long-term potentiation (LTP)**, refers to the strengthening of the synaptic connections between neurons as result of frequent stimulation (Lynch, 2002). Drugs that block LTP reduce learning, whereas drugs that enhance LTP increase learning (Lynch et al., 1991). Because the new patterns of activation in the synapses take time to develop, LTP happens gradually. The period of time in which LTP occurs and in which memories are stored is known as the period of *consolidation*.

Memory is not confined to the cortex; it occurs through sophisticated interactions between new and old brain structures (**FIGURE 20.9**). One of the most important brain regions in explicit memory is the hippocampus, which serves as a preprocessor and elaborator of information (Squire, 1992). The hippocampus helps us encode information about spatial relationships, the context in which events were experienced, and the associations among memories (Eichenbaum, 1999). The hippocampus also serves in part as a switching point that holds the memory for a short time and then directs the information to other parts of the brain, such as the cortex, to actually do the rehearsing, elaboration, and long-term storage (Jonides et al., 2005). Without the hippocampus, which might be described as the brain's "librarian," our explicit memories would be inefficient and disorganized.

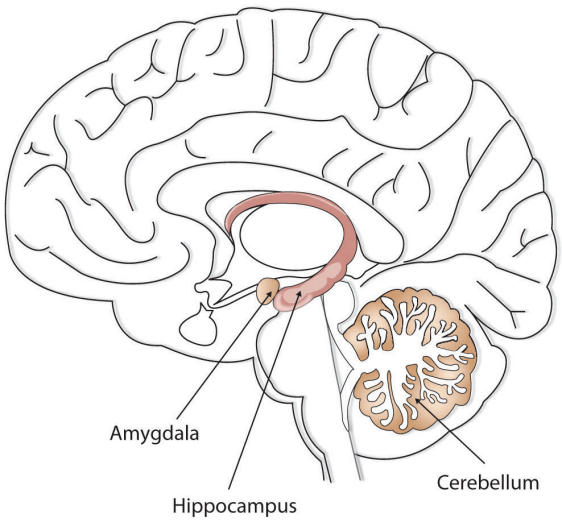

FIGURE 20.9. The hippocampus, amygdala, and cerebellum. Different brain structures help us remember different types of information. The hippocampus is particularly important in explicit memories, the cerebellum is particularly important in implicit memories, and the amygdala is particularly important in emotional memories. ["Schematic Image of Brain With Hippocampus, Amygdala, and Cerebellum Highlighted" by University of Minnesota is licensed under CC BY-NC-SA 4.0.]

While the hippocampus is handling explicit memory, the *cerebellum* and the *amygdala* are concentrating on implicit and emotional memories, respectively. Research shows that the cerebellum is more active when we are learning associations and in priming tasks, and animals and humans with damage to the cerebellum have more difficulty in classical conditioning studies (Krupa et al., 1993; Woodruff-Pak et al., 2000). The storage of many of our most important emotional memories, and particularly those related to fear, is initiated and controlled by the amygdala (Sigurdsson et al., 2007).

Evidence for the role of different brain structures in different types of memories comes in part from case studies of patients who suffer from **amnesia**, a memory disorder that involves the inability to remember information. As with memory interference effects, amnesia can work in either a forward or a backward direction, affecting retrieval or encoding. For people who suffer damage to the brain, for instance, as a result of a stroke or other trauma, the amnesia may work backward. The outcome is **retrograde amnesia**, a memory disorder that produces an inability to retrieve events that occurred before a given time. Demonstrating the fact that LTP takes time (the process of consolidation), retrograde amnesia is usually more severe for memories that occurred just prior to the trauma than it is for older memories, and events that occurred just before the event that caused memory loss may never be recovered because they were never completely encoded.

Organisms with damage to the hippocampus develop a type of amnesia that works in a forward direction to affect encoding, known as *anterograde amnesia*. **Anterograde amnesia** is the inability to transfer information from short-term into long-term memory, making it impossible to form new memories. One well-known case study was a man named Henry Gustav Molaison (before he died in 2008, he was referred to only as H. M.) who had parts of his hippocampus removed to reduce severe seizures (Corkin et al., 1997). Following the operation, Molaison developed virtually complete anterograde amnesia. Although he could remember most of what had happened before the operation, and particularly what had occurred early in his life, he could no longer create new memories. Molaison was said to have read the same magazines over and over again without any awareness of having seen them before.

Cases of anterograde amnesia also provide information about the brain structures involved in different types of memory (Bayley & Squire, 2005; Helmuth, 1999; Paller, 2004). Although Molaison's explicit memory was compromised because his hippocampus was damaged, his implicit memory was not (because his cerebellum was intact). He could learn to trace shapes in a mirror, a task that requires procedural memory, but he never had any explicit recollection of having performed this task or of the people who administered the test to him.

Although some brain structures are particularly important in memory, this does not mean that all memories are stored in one place. The American psychologist Karl Lashley (1929) attempted to determine where memories were stored in the brain by teaching rats how to run mazes, and then lesioning different brain structures to see if they were still able to complete the maze. This idea seemed straightforward, and Lashley expected to find that memory was stored in certain parts of the brain. But he discovered that no matter where he removed brain tissue, the rats retained at least some memory of the maze, leading him to conclude that memory isn't located in a single place in the brain, but rather is distributed around it.

Long-term potentiation occurs as a result of changes in the synapses, which suggests that chemicals, particularly neurotransmitters and hormones, must be involved in memory. There is quite a bit of evidence that this is true. *Glutamate*, a neurotransmitter and a form of the amino acid glutamic acid, is perhaps the most important neurotransmitter in memory (McEntee & Crook, 1993). When animals, including people, are under stress, more glutamate is secreted, and this glutamate can help them remember (McGaugh, 2003). The neurotransmitter *serotonin* is also secreted when animals learn, and *epinephrine* may also increase memory, particularly for stressful events (Maki & Resnick, 2000; Sherwin, 1998). *Estrogen*, a female sex hormone, also seems critical, because women who are experiencing menopause, along with a reduction in estrogen, frequently report memory difficulties (Chester, 2001).

Our knowledge of the role of biology in memory suggests that it might be possible to use drugs to improve our memories, and Americans spend several hundred million dollars per year on memory supplements with the hope of doing just that. Yet controlled studies comparing memory enhancers, including Ritalin, methylphenidate, ginkgo biloba, and amphetamines, with placebo drugs find very little evidence for their effectiveness (Gold et al., 2002; McDaniel et al., 2002). Memory supplements are usually no more effective than drinking a sugared soft drink, which also releases glucose and thus improves memory slightly. This is not to say that we cannot someday create drugs that will significantly improve our memory. It is likely that this will occur in the future, but the implications of these advances are as yet unknown (Farah et al., 2004; Turner & Sahakian, 2006).

Although the most obvious potential use of drugs is to attempt to improve memory, drugs might also be used to help us forget. This might be desirable in some cases, such as for those suffering from *posttraumatic stress disorder (PTSD)* who are unable to forget disturbing memories. Although there are no existing therapies that involve using drugs to help people forget, it is possible that they will be available in the future. These possibilities will raise some important ethical issues: Is it ethical to erase memories, and if it is, is it desirable to do so? Perhaps the experience of emotional pain is a part of being a human being. And perhaps the experience of emotional pain may help us cope with the trauma.

KEY TAKEAWAYS

- Information is better remembered when it is meaningfully elaborated.
- Hermann Ebbinghaus made important contributions to the study of learning, including modeling the forgetting curve, and studying the spacing effect and the benefits of overlearning.
- Context- and state-dependent learning, as well as primacy and recency effects, influence long-term memory.
- Memories are stored in connected synapses through the process of long-term potentiation (LTP). In addition to the cortex, other parts of the brain, including the hippocampus, the cerebellum, and the amygdala, are also important in memory.
- Damage to the brain may result in retrograde amnesia or anterograde amnesia. Case studies of patients with amnesia can provide information about the brain structures involved in different types of memory.
- Memory is influenced by chemicals including glutamate, serotonin, epinephrine, and estrogen.
- Studies comparing memory enhancers with placebo drugs find very little evidence for their effectiveness.

EXERCISES AND CRITICAL THINKING

1. Plan a course of action to help you study for your next exam, incorporating as many of the techniques mentioned in this section as possible. Try to implement the plan.
2. Make a list of some the schemas that you have stored in your memory. What are the contents of each schema, and how might you use the schema to help you remember new information?
3. In the film *Eternal Sunshine of the Spotless Mind*, the characters undergo a medical procedure designed to erase their memories of a painful romantic relationship. Would you engage in such a procedure if it was safely offered to you?

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READING 21

The Many Varieties of Conformity

SOURCE

University of Minnesota. (2015). *Principles of social psychology.* University of Minnesota Libraries Publishing.
https://open.lib.umn.edu/socialpsychology/

LEARNING OBJECTIVES

- Describe some of the active and passive ways that conformity occurs in our everyday lives.
- Compare and contrast informational conformity and normative conformity.
- Summarize the variables that create majority and minority social influence.
- Outline the situational variables that influence the extent to which we conform.

KEY TERMS

informational conformity
majority influence
minority influence
normative conformity
private acceptance
public conformity
social impact

The typical outcome of social influence is that our beliefs and behaviors become more similar to those of others around us. At times this change occurs in a spontaneous and automatic sense, without any obvious intent of one person to change the other. Perhaps you learned to like jazz or rap music because your roommate was playing a lot of it. You didn't really want to like the music, and your roommate didn't force it on you—your preferences changed in a passive way. Robert Cialdini and his colleagues (1990) found that college students were more likely to throw litter on the ground when they had just seen another person throw some paper on the ground and were least likely to litter when they had just seen another person pick up and throw paper into a trash can. The researchers interpreted this as a kind of spontaneous conformity—a tendency to follow the behavior of others, often entirely out of our awareness. Even our emotional states become more similar to those we spend more time with (Anderson et al., 2003).

INFORMATIONAL CONFORMITY: CONFORMING TO BE ACCURATE

Although mimicry represents the more subtle side, conformity also occurs in a more active and thoughtful sense, for instance, when we actively look to our friends' opinions to determine appropriate behavior, when a car salesperson attempts to make a sale, or even when a powerful dictator uses physical aggression to force the people in his country to engage in the behaviors that he desires. In these cases, the influence is obvious. We know we are being influenced and we may attempt—sometimes successfully, and sometimes less so—to counteract the pressure.

Influence sometimes occurs because we believe that other people have valid knowledge about an opinion or issue, and we use that information to help us make good decisions. When we take our winter coat to school because the weatherman says it's going to be cold, this is because we think that the weatherman has some good information that we can use. **Informational conformity** is the change in opinions or behavior that occurs when we conform to people whom we believe have accurate information. We base our beliefs on those presented to us by reporters, scientists, doctors, and lawyers because we believe they have more expertise in certain fields than we have. But we also use our friends and colleagues for information; when we choose a prom gown on the basis of our friends' advice about what looks good on us, we are using informational conformity—we believe that our friends have good judgment about the things that matter to us.

Informational conformity is often the end result of *social comparison*, the process of comparing our opinions with those of others to gain an accurate appraisal of the validity of an opinion or behavior (Festinger et al., 1950; Hardin & Higgins, 1996; Turner, 1991). Informational conformity leads to real, long-lasting changes in beliefs. The result of informational influence is normally **private acceptance**: real change in opinions on the part of the individual. We believe that taking the winter coat was the right thing to do and that the prom gown really looks good on us.

NORMATIVE CONFORMITY: CONFORMING TO BE LIKED AND TO AVOID REJECTION

In other cases we conform not because we want to have valid knowledge but rather to meet the goal of belonging to and

RESEARCH FOCUS

Imitation as Subtle Conformity

Perhaps you have noticed in your own behavior a type of very subtle conformity—the tendency to imitate other people who are around you. Have you ever found yourself talking, smiling, or frowning in the same way that a friend does? Tanya Chartrand and John Bargh (1999) investigated whether the tendency to imitate others would occur even for strangers, and even in very short periods of time.

In their first experiment, students worked on a task with another student, who was actually an experimental confederate. The two worked together to discuss photographs taken from current magazines. While they were working together, the confederate engaged in some unusual behaviors to see if the research participant would mimic them. Specifically, the confederate either rubbed his or her face or shook his or her foot. It turned out that the students did mimic the behavior of the confederate, by themselves either rubbing their own faces or shaking their own feet. And when the experimenters asked the participants if they had noticed anything unusual about the behavior of the other person during the experiment, none of them indicated awareness of any face rubbing or foot shaking.

It is said that imitation is a form of flattery, and we might therefore expect that we would like people who imitate us. Indeed, in a second experiment, Chartrand and Bargh found exactly this. Rather than creating the behavior to be mimicked, in this study the confederate imitated the behaviors of the participant. While the participant and the confederate discussed the magazine photos, the confederate mirrored the posture, movements, and mannerisms displayed by the participant.

As you can see in **FIGURE 21.1**, the participants who had been mimicked liked the other person more and indicated that they thought the interaction had gone more smoothly, in comparison with the participants who had not been imitated.

Imitation is an important part of social interaction. We easily and frequently mimic others without being aware that we are doing so. We may communicate to others that we agree with their viewpoints by mimicking their behaviors, and we tend to get along better with people with whom we are well "coordinated." We even expect people to mimic us in social interactions, and we become distressed when they do not (Dalton et al., 2010). This unconscious conformity may help explain why we hit it off immediately with some people and never get it together with others (Chartrand & Dalton, 2009; Tickle-Degnen & Rosenthal, 1990, 1992). ■

FIGURE 21.1. Participants who had been mimicked indicated that they liked the person who had imitated them more and that the interaction with that person had gone more smoothly, in comparison with participants who had not been mimicked. [This work, "Imitation and Likeability," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Figure 7.1" by University of Minnesota, which is licensed under CC BY-NC-SA 4.0. Data are from Chartrand and Bargh (1999).]

being accepted by a group we care about (Deutsch & Gerard, 1955). When we start smoking cigarettes or buy shoes we cannot really afford in order to impress others, we do these things not so much because we think they are the right things to do but rather because we want to be liked.

Normative conformity occurs when we express opinions or behave in ways that help us to be accepted or that keep us from being isolated or rejected by others. When we engage in normative conformity we conform to social norms—socially accepted beliefs about what we do or should do in particular social contexts (Cialdini, 1993; Sherif, 1936; Sumner, 1906).

In contrast to informational conformity, in which the attitudes or opinions of the individual change to match that of the influencers, the outcome of normative conformity often represents *public conformity* rather than private acceptance. **Public conformity** is a superficial change in behavior (including the public expression of opinions) that is not accompanied by an actual change in one's private opinion. Conformity may appear in our public behavior even though we may believe something completely different in private. We may obey the speed limit or wear a uniform to our job (behavior) to conform to social norms and requirements, even though we may not necessarily believe that it is appropriate to do so (opinion). We may use drugs with our friends without really wanting to, and without believing it is really right, because our friends are all using drugs. However, behaviors that are originally performed out of a desire to be accepted (normative conformity) may frequently produce changes in beliefs

to match them, and the result becomes private acceptance. Perhaps you know someone who started smoking to please his friends but soon convinced himself that it was an acceptable thing to do.

Although in some cases conformity may be purely informational or purely normative, in most cases the goals of being accurate and being accepted go hand-in-hand, and therefore informational and normative conformity often occur at the same time. When soldiers obey their commanding officers, they probably do it both because others are doing it (normative conformity) and because they think it is the right thing to do (informational conformity). It has been argued that the distinction between informational and normative conformity is more apparent than real and that it may not be possible to fully differentiate them (Turner, 1991).

MAJORITY INFLUENCE: CONFORMING TO THE GROUP

Although conformity occurs whenever group members change their opinions or behaviors as a result of their perceptions of others, we can divide such influence into two types. **Majority influence** occurs when the beliefs held by the larger number of individuals in the current social group prevail. In contrast, **minority influence** occurs when the beliefs held by the smaller number of individuals in the current social group prevail. Not surprisingly, majority influence is more common, and we will consider it first.

In a series of important studies on conformity, Muzafer Sherif (1936) used a perceptual phenomenon known as the *autokinetic effect* to study the outcomes of conformity on the development of group norms. The autokinetic effect is caused by the rapid, small movements of our eyes that occur as we view objects and that allow us to focus on stimuli in our environment. However, when individuals are placed in a dark room that contains only a single, small, stationary pinpoint of light, these eye movements produce an unusual effect for the perceiver—they make the point of light appear to move.

Sherif took advantage of this effect to study how group norms develop in ambiguous situations. In his studies, college students were placed in a dark room with the point of light and were asked to indicate, each time the light was turned on, how much it appeared to move. Some participants first made their judgments alone. Sherif found that although each participant who was tested alone made estimates that were within a relatively narrow range (as if they had their own "individual" norm), there were wide variations in the size of these judgments among the different participants he studied.

Sherif also found that when individuals who initially had made very different estimates were then placed in groups along with one or two other individuals, and in which all the group members gave their responses on each trial aloud (each time in a different random order), the initial differences in judgments among the participants began to disappear, such that the group members eventually made very similar judgments. You can see that this pattern of change, which is shown in **FIGURE 21.2**, illustrates the fundamental principle of social influence—over time, people come more and more to share their beliefs with each other. Sherif's study is thus a powerful example of the development of group norms.

Furthermore, and indicating that Sherif had created private acceptance, the new group norms continued to influence judgments when the individuals were again tested alone. The

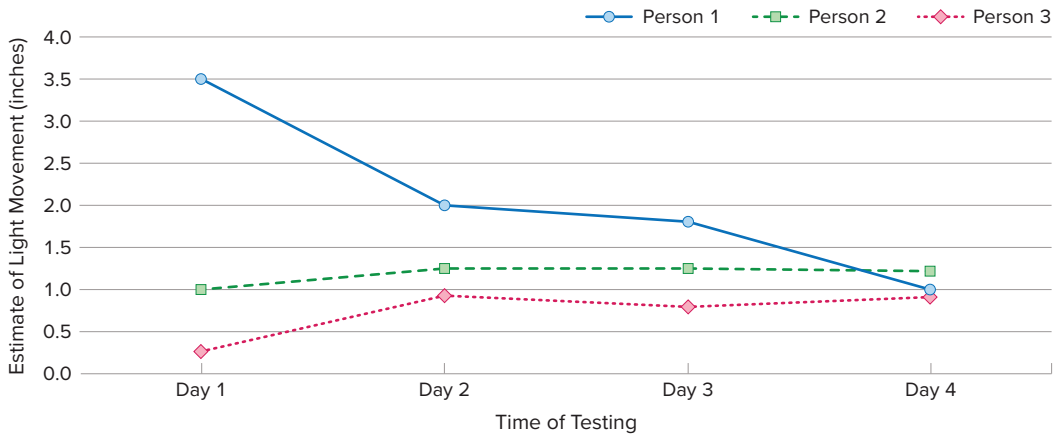


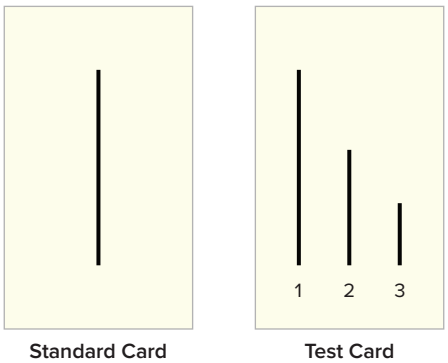
FIGURE 21.2. The participants in the studies by Muzafer Sherif (1936) initially had different beliefs about the degree to which a point of light appeared to be moving. (You can see these differences as expressed on Day 1.) However, as they shared their beliefs with other group members over several days, a common group norm developed. Shown here are the estimates made by a group of three participants who met together on four different days. [This work, "Conformity and Light Movement," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Outcomes of Sherif's Study" by University of Minnesota, which is licensed under CC BY-NC-SA 4.0.]

participants did not revert back to their initial opinions, even though they were quite free to do so; rather, they stayed with the new group norms. And these conformity effects appear to have occurred entirely out of the awareness of most participants. Sherif (1936, p. 108) reported that the majority of the participants indicated after the experiment was over that their judgments had not been influenced by the judgments made by the other group members.

Sherif also found that the norms that were developed in groups could continue over time. When the original research participants were moved into groups with new people, their opinions subsequently influenced the judgments of the new group members (Jacobs & Campbell, 1961). The norms persisted through several "generations" (MacNeil & Sherif, 1976) and could influence individual judgments up to a year after the individual was last tested (Rohrer et al., 1954).

When Solomon Asch (1952, 1955) heard about Sherif's studies, he responded in perhaps the same way that you might have: "Well of course people conformed in this situation, because after all the right answer was very unclear," you might have thought. Since the study participants didn't know the right answer (or indeed the "right" answer was no movement at all), it is perhaps not that surprising that people conformed to the beliefs of others.

Asch conducted studies in which, in complete contrast to the autokinetic effect experiments of Sherif, the correct answers to the judgments were entirely unambiguous. In these studies, the research participants were male college students who were told that they were to be participating in a test of visual abilities. The men were seated in a small semicircle in front of a board that displayed the visual stimuli that they were going to judge. The men were told that there would be 18 trials during the experiment, and on each trial they would see two cards. The standard card had a single line that was to be judged, and the test card had three lines that varied in length between about 2 and 10 inches:



The men's task was simply to indicate which line on the test card was the same length as the line on the standard card. As you can see from the Asch card sample above, there is no question that the correct answer is line 1. In fact, Asch found that people made virtually no errors on the task when they made their judgments alone.

On each trial, each person answered out loud, beginning with one end of the semicircle and moving to the other end. Although the participant did not know it, the other group members were not true participants but experimental confederates who gave predetermined answers on each trial. Because the participant was seated next to last in the row, he always made his judgment after most of the other group members made theirs. Although on the first two trials the confederates each gave the correct answer, on the third trial, and on 11 of the subsequent trials, they all had been instructed to give the same incorrect answer. For instance, even though the correct answer was Line 1, they would all say it was Line 2. Thus when it became the participant's turn to answer, he could either give the clearly correct answer or conform to the incorrect responses of the confederates.

Asch found that about 76% of the 123 men who were tested gave at least one incorrect response when it was their turn, and 37% of the responses, overall, were conforming. This is indeed evidence for the power of conformity because the research participants were giving clearly incorrect answers out loud. However, conformity was not absolute—in addition to the 24% of the men who never conformed, only 5% of the men conformed on all 12 of the critical trials.

You might think that Asch's study shows primarily normative conformity, in the sense that the participants gave the wrong answer not because they thought it was correct but because they wanted to avoid being seen as different. But is it not possible that the participants were also a bit unsure of the correct answer? When I look at the picture of one of the participants in Asch's studies, it looks to me like he is really unsure about what he is seeing. Perhaps, then, even in Asch's study some informational influence is occurring. Maybe the participants became unsure of their responses and used the opinions of others to help them determine what was correct. Normative and informational conformity often operate together.

MINORITY INFLUENCE: RESISTING GROUP PRESSURE

The research that we have discussed to this point involves conformity in which the opinions and behaviors of individuals become more similar to the opinions and behaviors of the majority of the people in the group—majority influence. But we do not always blindly conform to the beliefs of the majority. Although more unusual, there are nevertheless cases in which a smaller number of individuals are able to influence the opinions or behaviors of the group—this is *minority influence*.

Galileo, Copernicus, and Martin Luther were people who did not conform to the opinions and behaviors of those around them. In the end, their innovative ideas changed the thinking of the masses. ["Portrait of Galileo Galilei" by Justus Sustermans/ Wikimedia Commons, "Nikolaus Kopernikus"/ Wikimedia Commons, and "Martin Luther by Cranach-restoration" by Lucas Cranach the Elder/ Wikimedia Commons are in the public domain.]

It is a good thing that minorities can be influential; otherwise, the world would be pretty boring. When we look back on history we find that it is the unusual, divergent, innovative minority groups or individuals who—although frequently ridiculed at the time for their unusual ideas—end up being respected for producing positive changes. The work of scientists, religious leaders, philosophers, writers, musicians, and artists who go against group norms by expressing new and unusual ideas frequently is not liked at first. These novel thinkers may be punished—in some cases even killed—for their beliefs. In the end, however, if the ideas are interesting and important, the majority may conform to these new ideas, producing social change. In short, although conformity to majority opinions is essential to provide a smoothly working society, if individuals only conformed to others there would be few new ideas and little social change.

The French social psychologist Serge Moscovici was particularly interested in the situations under which minority influence might occur. In fact, he argued that all members of all groups are able, at least in some degree, to influence others, regardless of whether they are in the majority or the minority. To test whether minority group members could indeed produce influence, he and his colleagues (Moscovici et al., 1969) created the opposite of Asch's line perception study, such that there was now a minority of confederates in the group (two) and a majority of experimental participants (four). All six individuals viewed a series of slides depicting colors, supposedly as a study of color perception, and as in Asch's research, each voiced out loud an opinion about the color of the slide.

Although the color of the slides varied in brightness, they were all clearly blue. Moreover, demonstrating that the slides were unambiguous, just as the line judgments of Asch had been, participants who were asked to make their judgments alone called the slides a different color than blue less than 1% of the time. (When it happened, they called the slides green.)

In the experiment, the two confederates had been instructed to give one of two patterns of answers that were different from the normal responses. In the *consistent-minority* condition, the two confederates gave the unusual response (green) on every trial. In the *inconsistent-minority* condition the confederates called the slides "green" on two thirds of their responses and called them blue on the other third.

The minority of two was able to change the beliefs of the majority of four, but only when they were unanimous in their judgments. As shown in **FIGURE 21.3**, Moscovici found that the presence of a minority who gave consistently unusual responses influenced the judgments made by the experimental participants. When the minority was consistent, 32% of the majority group participants said green at least once and 18% of the responses of the majority group were green. However, as you can see in **FIGURE 21.3**, the inconsistent minority had virtually no influence on the judgments of the majority.

On the basis of this research, Moscovici argued that minorities could have influence over majorities, provided they gave consistent, unanimous responses. Subsequent research has found that minorities are most effective when they express consistent opinions over time and with each

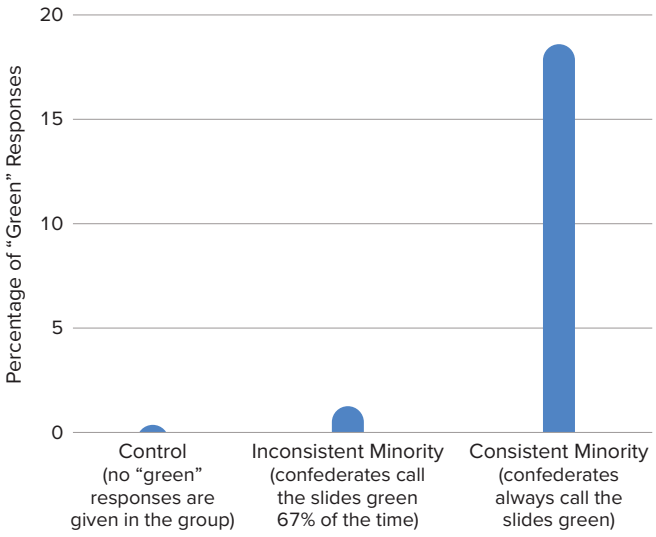


FIGURE 21.3. The power of consistent minorities. In the studies of minority influence by Serge Moscovici, only a consistent minority (in which each individual gave the same incorrect response) was able to produce conformity in the majority participants. [This work, "Power of Consistent Minorities," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "The Power of Consistent Minorities" by University of Minnesota, which is licensed under CC BY-NC-SA 4.0. Data are from Moscovici et al. (1969).]

other, when they show that they are invested in their position by making significant personal and material sacrifices, and when they seem to be acting out of principle rather than from ulterior motives (Hogg, 2010). Although they may want to adopt a relatively open-minded and reasonable negotiating style on issues that are less critical to the attitudes they are trying to change, successful minorities must be absolutely consistent with regard to their core arguments (Mugny & Papastamou, 1981).

When minorities are successful at producing influence, they are able to produce strong and lasting attitude change—true private acceptance—rather than simply public conformity. People conform to minorities because they think that they are right, and not because they think it is socially acceptable. Minorities have another, potentially even more important, outcome on the opinions of majority group members—the presence of minority groups can lead majorities to engage in fuller, as well as more divergent, innovative and creative thinking about the topics being discussed (Martin & Hewstone, 2003; Martin et al., 2007).

Nemeth and Kwan (1987) had participants work in groups of four on a creativity task in which they were presented with letter strings such as *tdogto* and asked to indicate which word came to their mind first as they looked at the letters. The judgments were made privately, which allowed the experimenters to provide false feedback about the responses of the other group members. All participants indicated the most obvious word (in this case, *dog*) as their response on each of the initial trials. However, the participants were told (according to experimental condition) either that three of the other group members had also reported seeing *dog* and that one had reported seeing *god* or that three out of the four had reported seeing *god* whereas only one had reported *dog*. Participants then completed other similar word strings on their own, and their responses were studied.

Results showed that when the participants thought that the unusual response (for instance, *god* rather than *dog*) was given by a minority of one individual in the group rather than by a majority of three individuals, they subsequently answered more of the new word strings using novel solutions, such as finding words made backward or using a random order of the letters. On the other hand, the individuals who thought that the majority of the group had given the novel response did not develop more creative ideas. The idea is when the participants thought that the novel response came from a group minority (one person), they thought about the responses more carefully, in comparison with the same behaviors performed by majority group members, and this led them to adopt new and creative ways to think about the problems. This result, along with other research showing similar findings, suggests that messages that come from minority groups lead us to think more fully about the decision, which can produce innovative, creative thinking in majority group members (Crano & Chen, 1998).

In summary, we can conclude that minority influence, although not as likely as majority influence, does sometimes occur. The few are able to influence the many when they are consistent and confident in their judgments but are less able to have influence when they are inconsistent or act in a less confident manner. Furthermore, although minority influence is difficult to achieve, if it does occur it is powerful. When majorities are influenced by minorities they really change their beliefs—the outcome is deeper thinking about the message, private acceptance of the message, and in some cases even more creative thinking.

SITUATIONAL DETERMINANTS OF CONFORMITY

The studies of Asch, Sherif, and Moscovici demonstrate the extent to which individuals—both majorities and minorities—can create conformity in others. Furthermore, these studies provide information about the characteristics of the social situation that are important in determining the extent to which we conform to others. Let's consider some of those variables.

The Size of the Majority

As the number of people in the majority increases, relative to the number of persons in the minority, pressure on the minority to conform also increases (Latané, 1981; Mullen, 1983). Asch conducted replications of his original line-judging study in which he varied the number of confederates (the majority subgroup members) who gave initial incorrect responses from 1 to 16 people, while holding the number in the minority subgroup constant at 1 (the single research participant). You may not be surprised to hear the results of this research: When the size of the majorities got bigger, the lone participant was more likely to give the incorrect answer.

Increases in the size of the majority increase conformity, regardless of whether the conformity is informational or normative. In terms of informational conformity, if more people express an opinion, their opinions seem more valid. Thus bigger majorities should result in more informational conformity. But larger majorities will also produce more normative conformity because being different will be harder when the majority is bigger. As the majority gets bigger, the individual giving the different opinion becomes more aware of being different, and this produces a greater need to conform to the prevailing norm.

Although increasing the size of the majority does increase conformity, this is only true up to a point. The increase in the amount of conformity that is produced by adding new members to the majority group (known as the **social impact** of each group member) is greater for initial majority members

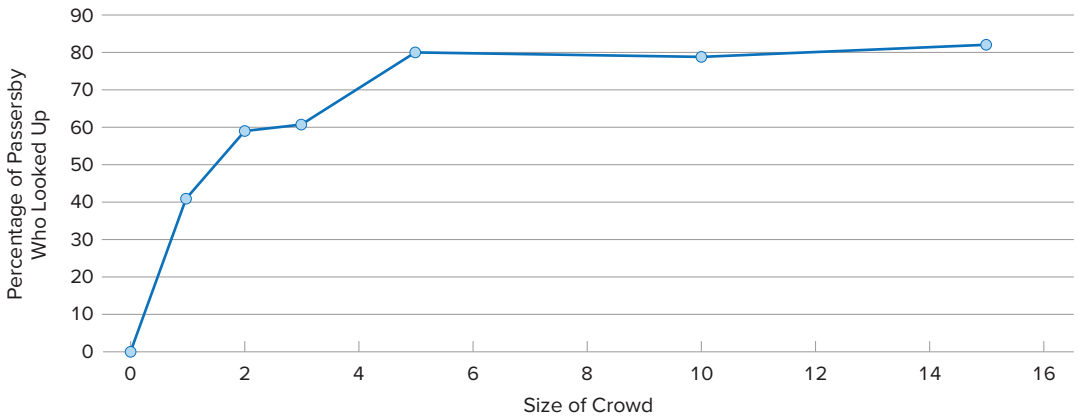


FIGURE 21.4. Social impact. This figure shows the percentage of participants who looked up as a function of the size of the crowd on the street in Milgram's (1969) study on the streets of New York. You can see that the amount of conformity increases dramatically until there are five participants, after which it levels off. Similar patterns have been found in many other studies of conformity. [This work, "Social Impact," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Social Impact" by University of Minnesota, which is licensed under CC BY-NC-SA 4.0.]

than it is for later members (Latané, 1981). This pattern is shown in **FIGURE 21.4**, which presents data from a well-known experiment by Stanley Milgram and his colleagues (1969) that studied how people are influenced by the behavior of others on the streets of New York City.

Milgram had confederates gather in groups on 42nd Street in New York City, in front of the Graduate Center of the City University of New York, each looking up at a window on the sixth floor of the building. The confederates were formed into groups ranging from one to 15 people. A video camera in a room on the sixth floor above recorded the behavior of 1,424 pedestrians who passed along the sidewalk next to the groups.

As you can see in **FIGURE 21.4**, larger groups of confederates increased the number of people who also stopped and looked up, but the influence of each additional confederate was generally weaker as size increased. Groups of three confederates produced more conformity than did a single person, and groups of five produced more conformity than groups of three. But after the group reached about six people, it didn't really matter very much. Just as turning on the first light in an initially dark room makes more difference in the brightness of the room than turning on the second, third, and fourth lights does, adding more people to the majority tends to produce diminishing returns—less effect on conformity.

Group size is an important variable that influences a wide variety of behaviors of the individuals in groups. People leave proportionally smaller tips in restaurants as the number in their party increases, and people are less likely to help as the number of bystanders to an incident increases (Latané, 1981). The number of group members also has an important influence on group performance: As the size of a working group gets larger, the contributions of each individual member to the group effort become smaller. In each case, the influence of group size on behavior is found to be similar to that shown in **FIGURE 21.4**.

As you can see in **FIGURE 21.4**, the effect of adding new individuals to the group eventually levels off entirely, such that adding more people to the majority after that point makes no meaningful difference in the amount of conformity. This peak usually occurs when the majority has about four or five persons. One reason that the impact of new group members decreases so rapidly is because as the number in the group increases, the individuals in the majority are soon seen more as a group rather than as separate individuals. When there are only a couple of individuals expressing opinions, each person is likely to be seen as an individual, holding his or her own unique opinions, and each new individual adds to the impact. As a result, two people are more influential than one, and three more influential than two. However, as the number of individuals grows, and particularly when those individuals are perceived as being able to communicate with each other, the individuals are more likely to be seen as a group rather than as individuals. At this point, adding new members does not change the perception; regardless of whether there are four, five, six, or more members, the group is still just a group. As a result, the expressed opinions or behaviors of the group members no longer seem to reflect their own characteristics, so much as they do that of the group as a whole, and thus increasing the number of group members is less effective in increasing influence (Wilder, 1977).

The Unanimity of the Majority

Although the number of people in the group is an important determinant of conformity, it cannot be the only thing—if it

were, minority influence would be impossible. It turns out that the *consistency* or *unanimity* of the group members is even more important. In Asch's study, as an example, conformity occurred not so much because many confederates gave a wrong answer but rather because each of the confederates gave the same wrong answer. In one follow-up study that he conducted, Asch increased the number of confederates to 16 but had just one of those confederates give the correct answer. He found that in this case, even though there were 15 incorrect and only one correct answer given by the confederates, conformity was nevertheless sharply reduced—to only about 5% of the participants' responses. And you will recall that in the minority influence research of Moscovici, the same thing occurred; conformity was only observed when the minority group members were completely consistent in their expressed opinions.

Although you might not be surprised to hear that conformity decreases when one of the group members gives the right answer, you may be more surprised to hear that conformity is reduced even when the dissenting confederate gives a different *wrong* answer. For example, conformity is reduced dramatically in Asch's line-judging situation, such that virtually all participants give the correct answer (assume it is line 3 in this case) even when the majority of the confederates have indicated that line 2 is the correct answer and a single confederate indicates that line 1 is correct. In short, conformity is reduced when there is any inconsistency among the members of the majority group—even when one member of the majority gives an answer that is even more incorrect than that given by the other majority group members (Allen & Levine, 1968).

Why should unanimity be such an important determinant of conformity? For one, when there is complete agreement among the majority members, the individual who is the target of influence stands completely alone and must be the first to break ranks by giving a different opinion. Being the only person who is different is potentially embarrassing, and people who wish to make a good impression on, or be liked

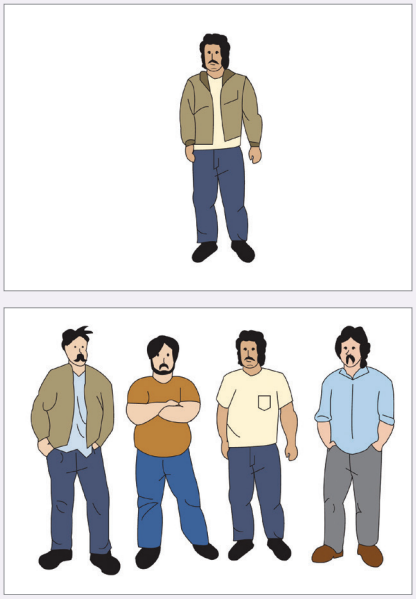
RESEARCH FOCUS

How Task Importance and Confidence Influence Conformity

The joint influence of an individual's confidence in his or her beliefs and the importance of the task was demonstrated in an experiment conducted by Baron et al. (1996) that used a slight modification of the Asch procedure to assess conformity. Participants completed the experiment along with two other students, who were actually experimental confederates. The participants worked on several different types of trials, but there were 26 that were relevant to the conformity predictions. On these trials, a photo of a single individual was presented first, followed immediately by a "lineup" photo of four individuals, one of whom had been viewed in the initial slide (but who might have been dressed differently).

The participants' task was to call out which person in the lineup was the same as the original individual using a number between 1 (the person on the left) and 4 (the person on the right). In each of the critical trials the two confederates went before the participant and they each gave the same wrong response.

Two experimental manipulations were used. First, the researchers manipulated task importance by telling some participants (the *high importance condition*) that their performance on the task was an important measure of eyewitness ability and that the participants who performed most accurately would receive $20 at the end of the data collection. (A lottery using all the participants was actually held at the end of the semester, and some participants were paid the



[This work, "Lineup," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of an untitled image by University of Minnesota, which is licensed under CC BY-NC-SA 4.0.]

by, others may naturally want to avoid this. If you can convince your friend to wear blue jeans rather than a coat and tie to a wedding, then you're naturally going to feel a lot less conspicuous when you wear jeans too.

Second, when there is complete agreement—remember the consistent minority in the studies by Moscovici—the participant may become less sure of his or her own perceptions. Because everyone else is holding the exact same opinion, it seems that they must be correctly responding to the external reality. When such doubt occurs, the individual may be likely to conform due to informational conformity. Finally, when one or more of the other group members gives a different answer than the rest of the group (so that the unanimity of the majority group is broken), that person is no longer part of the group that is doing the influencing and becomes (along with the participant) part of the group being influenced. You can see that another way of describing the effect of unanimity is to say that as soon as the individual has someone who agrees with him or her that the others may not be correct (a supporter or ally), then the pressure to conform is reduced. Having one or more supporters who challenge the status quo validates one's own opinion and makes disagreeing with the majority more likely (Allen, 1975; Boyanowsky & Allen, 1973).

The Importance of the Task

Still another determinant of conformity is the perceived importance of the decision. The studies of Sherif, Asch, and Moscovici may be criticized because the decisions that the participants made—for instance, judging the length of lines or the colors of objects—seem rather trivial. But what would happen when people were asked to make an important decision? Although you might think that conformity would be less when the task becomes more important (perhaps because people would feel uncomfortable relying on the judgments of others and want to take more responsibility for their own decisions), the influence of task importance actually turns out to be more complicated than that.

$20.) Participants in the *low-importance condition*, on the other hand, were told that the test procedure was part of a pilot study and that the decisions were not that important. Second, task difficulty was varied by showing the test and the lineup photos for 5 and 10 seconds, respectively (*easy condition*) or for only ½ and 1 second, respectively (*difficult condition*). The conformity score was defined as the number of trials in which the participant offered the same (incorrect) response as the confederates.

As you can see in **FIGURE 21.5**, an interaction between task difficulty and task importance was observed. On easy tasks, participants conformed less to the incorrect judgments of others when the decision had more important consequences for them. In these cases, they seemed to rely more on their own opinions (which they were convinced were correct) when it really mattered, but were more likely to go along with the opinions of the others when things were not that critical (probably normative conformity).

On the difficult tasks, however, results were the opposite. In this case, participants conformed more when they thought the decision was of high, rather than low, importance. In these cases in which they were more unsure of their opinions and yet they really wanted to be correct, they used the judgments of others to inform their own views (informational conformity). ■

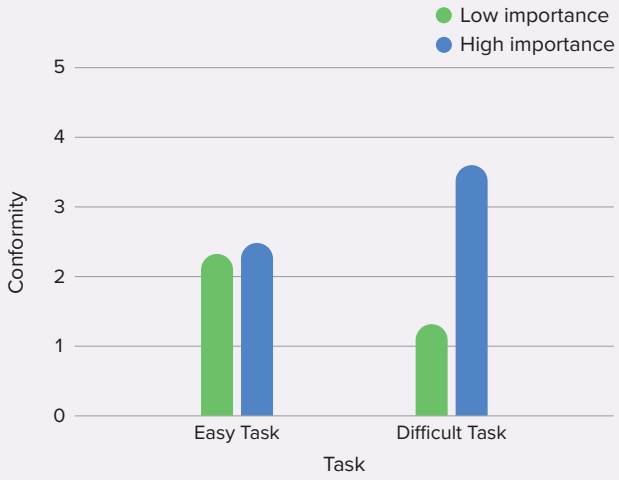


FIGURE 21.5. On easy tasks, participants conformed less when they thought that the decision was of high (versus low) importance, whereas on difficult tasks, participants conformed more when they thought the decision was of high importance. [This work, "Conformity, Task Difficulty, and Importance," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Figure 7.6" by University of Minnesota, which is licensed under CC BY-NC-SA 4.0. Data are from Baron et al. (1996).]

KEY TAKEAWAYS

- Social influence creates conformity.
- Influence may occur in more passive or more active ways.
- We conform both to gain accurate knowledge (informational conformity) and to avoid being rejected by others (normative conformity).
- Both majorities and minorities may create social influence, but they do so in different ways.
- The characteristics of the social situation, including the number of people in the majority and the unanimity of the majority, have a strong influence on conformity.

EXERCISES AND CRITICAL THINKING

1. Describe a time when you conformed to the opinions or behaviors of others. Interpret the conformity in terms of the concepts discussed in this section.
2. Imagine you were serving on a jury trial in which you found yourself the only person who believed that the defendant was innocent. What strategies might you use to convince the majority?

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READING 22

Obedience, Power, and Leadership

SOURCE

University of Minnesota. (2015). *Principles of social psychology.* University of Minnesota Libraries Publishing.
https://open.lib.umn.edu/socialpsychology/

LEARNING OBJECTIVES

- Describe and interpret the results of Stanley Milgram's research on obedience.
- Compare the different types of power proposed by John French and Bertram Raven and explain how they produce conformity.
- Define leadership and explain how effective leaders are determined by the person, the situation, and the person-situation interaction.

KEY TERMS

charismatic leaders
coercive power
contingency model of leadership effectiveness
expert power
leadership
legitimate power
personality theories of leadership
referent power
reward power
social power

One of the fundamental aspects of social interaction is that some individuals have more influence than others. **Social power** can be defined as the ability of a person to create conformity even when the people being influenced may attempt to resist those changes (Fiske, 1993; Keltner et al., 2003). Bosses have power over their workers, parents have power over their children, and, more generally, we can say that those in authority have power over their subordinates. In short, power refers to the process of social influence itself—those who have power are those who are most able to influence others.

MILGRAM'S STUDIES ON OBEDIENCE TO AUTHORITY

The powerful ability of those in authority to control others was demonstrated in a remarkable set of studies performed by Stanley Milgram (1974). Milgram was interested in understanding the factors that lead people to obey the orders given by people in authority. He designed a study in which he could observe the extent to which a person who presented himself as an authority would be able to produce obedience, even to the extent of leading people to cause harm to others.

MILGRAM'S OBEDIENCE TO AUTHORITY EXPERIMENT

Watch this video about Milgram's experiment.

Like many other social psychologists, Milgram's interest in conformity stemmed in part from his desire to understand how the presence of a powerful person—particularly the German dictator Adolph Hitler, who ordered the killing of millions of people during World War II—could produce obedience. Under Hitler's direction, the German SS troops oversaw the execution of 6 million Jews as well as other "undesirables," including political and religious dissidents, homosexuals, the mentally and physically disabled, and prisoners of war.

Milgram used newspaper ads to recruit men (and, in one study, women) from a wide variety of backgrounds to participate in his research. When the research participant arrived at the lab, he or she was introduced to a man whom the participant believed was another research participant but who was actually an experimental confederate. The experimenter explained that the goal of the research was to study the effects of punishment on learning. After the participant and the confederate both consented to be in the study, the researcher explained that one of them would be the teacher and the other the learner. They were each given a slip of paper and asked to open it and to indicate what it said. In fact, both papers read *teacher*, which allowed the confederate to pretend that he had been assigned to be the learner and thus to assure that the actual participant was always the teacher.

While the research participant (now the teacher) looked on, the learner was taken into the adjoining shock room and strapped to an electrode that was to deliver the punishment. The experimenter explained that the teacher's job would be to sit in the control room and to read a list of word pairs to the learner. After the teacher read the list once, it would be the learner's job to remember which words went together. For instance, if the word pair was *blue-sofa*, the teacher would say the word *blue* on the testing trials and the learner would have

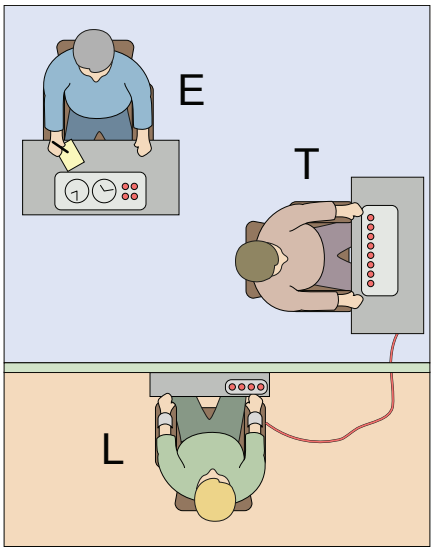


FIGURE 22.1. The setup of Stanley Milgram's experiment. The experimenter (E) convinces the subject ("Teacher," T) to give what he believes are painful electric shocks to another subject, who is actually an actor ("Learner," L). ["Milgram experiment v2" by Fred the Oyster/Wikimedia Commons is licensed under CC BY-SA 4.0.]

to indicate which of four possible words (*house*, *sofa*, *cat*, or *carpet*) was the correct answer by pressing one of four buttons in front of him.

After the experimenter gave the "teacher" a sample shock (which was said to be at 45 volts) to demonstrate that the shocks really were painful, the experiment began. The research participant first read the list of words to the learner and then began testing him on his learning. The shock panel was presented in front of the teacher, as shown in **FIGURE 22.1**, and the learner was not visible in the shock room. The experimenter sat behind the teacher and explained to him that each time the learner made a mistake the teacher was to press one of the shock switches to administer the shock. Moreover, which switch was to be pressed increased by one level with each mistake, such that each mistake required a stronger shock.

Once the learner (who was, of course, actually an experimental confederate) was alone in the shock room, he unstrapped himself from the shock machine and brought out a tape recorder that he used to play a prerecorded series of responses that the teacher could hear through the wall of the room.

As you can see in **TABLE 22.1**, the teacher heard the learner say "ugh!" after the first few shocks. After the next few mistakes, when the shock level reached 150 volts, the learner was heard to exclaim, "Let me out of here. I have heart trouble!" As the shock reached about 270 volts the learner's protests became more vehement, and after 300 volts the learner proclaimed that he was not going to answer any more questions.

TABLE 22.1. The Confederate's Schedule of Protest in the Milgram Experiments

75 volts	Ugh!
90 volts	Ugh!
105 volts	Ugh! (*louder*)
120 volts	Ugh! Hey, *this* really hurts.
135 volts	Ugh!!
150 volts	Ugh!! Experimenter! That's all. Get me out of here. I told you I had heart trouble. My heart's starting to bother me now. Get me out of here, please. My heart's starting to bother me. I refuse to go on. Let me out!
165 volts	Ugh! Let me out! (*shouting*)
180 volts	Ugh! I can't stand the pain. Let me out of here! (*shouting*)
195 volts	Ugh! Let me out of here! Let me out of here! My heart's bothering me. Let me out of here! You have no right to keep me here! Let me out! Let me out of here! Let me out! Let me out of here! My heart's bothering me. Let me out! Let me out!
210 volts	Ugh!! Experimenter! *Get* me out of here. I've had enough. I *won't* be in the experiment any more.
225 volts	Ugh!
240 volts	Ugh!
255 volts	Ugh! Get me *out* of here.
270 volts	(*agonized scream*) Let me out of here. Let me out of here. Let me out of here. Let me out. Do you hear? Let me out of here.
285 volts	(*agonized scream*)
300 volts	(*agonized scream*) I absolutely refuse to answer any more. Get me out of here. You can't hold me here. Get me out. Get me out of here.
315 volts	(*intensely agonized scream*) Let me out of here. Let me out of here. My heart's bothering me. Let me out, I tell you. (*hysterically*) Let me out of here. Let me out of here. You have no right to hold me here. Let me out! Let me out! Let me out! Let me out of here! Let me out! Let me out!

From 330 volts and up the learner was silent. The experimenter responded to participants' questions at this point, if they asked any, with a scripted response indicating that they should continue reading the questions and applying increasing shock when the learner did not respond.

The results of Milgram's research were themselves quite shocking. Although all of the participants gave the initial mild levels of shock, responses varied after that. Some refused to continue after about 150 volts, despite the insistence of the experimenter to continue to increase the shock level. Still others, however, continued to present the questions, and

to administer the shocks, under the pressure of the experimenter, who demanded that they continue. In the end, 65% of the participants continued giving the shock to the learner all the way up to the 450-volt maximum, even though that shock was marked as "danger: severe shock" and there had been no response heard from the participant for several trials. In sum, well over half of the men who participated had, as far as they knew, shocked another person to death, all as part of a supposed experiment on learning.

In case you are thinking that such high levels of obedience would not be observed in today's modern culture, there is, in fact, evidence that they would be. Studies similar to Milgram's findings have been conducted all over the world (Blass, 1999) and have found similar levels of conformity, with obedience rates ranging from a high of 90% in Spain and the Netherlands (Meeus & Raaijmakers, 1986) to a low of 16% among Australian women (Kilham & Mann, 1974).

Recently, Milgram's results were almost exactly replicated, using men and women from a wide variety of ethnic groups, in a study conducted by Jerry Burger at Santa Clara University. In this replication of the Milgram experiment, 65% of the men and 73% of the women agreed to administer increasingly painful electric shocks when they were ordered to by an authority figure (Borge, 2007). In the replication, however, the participants were not allowed to go beyond the 150 volt shock switch.

Although it might be tempting to conclude that Milgram's experiments demonstrate that people are innately evil creatures who are ready to shock others to death, Milgram did not believe that this was the case. Rather, he felt that it was the social situation, and not the people themselves, that was responsible for the behavior. To demonstrate this, Milgram conducted research that explored a number of variations on his original procedure, each of which demonstrated that changes in the situation could dramatically influence the amount of conformity. These variations are summarized in **TABLE 22.2**, which presents the percentage of participants who were maximally obedient (that is, who gave all 450 volts of shock) in some of the variations that he conducted.

In the initial study, the authority's status and power was maximized—the experimenter had been introduced as a respected scientist at a respected university. However, in replications of the study in which the experimenter's authority was decreased, obedience also declined. In one replication, the status of the experimenter was reduced by having the experiment take place in a building located in Bridgeport, Connecticut, rather than at the labs on the Yale University campus, and the research was ostensibly sponsored by a private commercial research firm instead of by the university. In this study, less obedience was observed (only 48% of the participants delivered the maximum shock). Full obedience was also reduced (to 20%) when the experimenter's ability to express his authority was limited by having him sit in an adjoining room and communicate to the teacher by telephone. And when the experimenter left the room and had another student (actually a confederate) give the instructions for him, conformity was also reduced to 20%.

In addition to the role of authority, Milgram's studies also confirmed the role of unanimity in producing conformity. When another research participant (again an experimental confederate) began by giving the shocks but then later refused to continue and the participant was asked to take over, only 10% were obedient. And if two experimenters were present but only one proposed shocking while the other argued for stopping the shocks, all the research participants took the more benevolent advice and did not shock. Finally, in another condition the teacher sat next to the learner and was forced to wear an insulated glove and to hold the learner's hand on the shock pad as he administered the shock. Again, obedience was reduced, this time to only 30%.

Perhaps most telling regarding the important role of the situation were the studies in which Milgram allowed the participants to choose their own shock levels or in which one of the experimenters suggested that they should not actually

TABLE 22.2. Authority and Obedience in Stanley Milgram's Studies

Experimental Replication	Description	Percent Obedience
Experiment 1	Initial study: Yale University men and women	65
Experiment 10	Study conducted off campus, in Bridgeport, CT	48
Experiment 3	Teacher in the same room as learner	40
Experiment 4	Participant must hold learner's hand on shock pad	30
Experiment 7	Experimenter communicates by phone from another room	20
Experiment 13	An "ordinary man" (presumably another research participant) gives orders	20
Experiment 17	Two other research participants refuse to give shocks	10
Experiment 11	Teacher chooses his own preferred shock level	0
Experiment 15	One experimenter indicates that participant should not shock	0

SOCIAL PSYCHOLOGY IN THE PUBLIC INTEREST

The Zimbardo Prison Studies and Abu Ghraib

In Milgram's research we can see a provocative demonstration of how people who have power can control the behavior of others. Can our understanding of the social psychological factors that produce conformity and obedience help us explain the events that occurred in 2004 at Abu Ghraib, the Iraqi prison in which U.S. soldiers physically and psychologically tortured their Iraqi prisoners? The social psychologist Philip Zimbardo thinks so. He notes the parallels between the events that occurred at Abu Ghraib and the events that occurred in the "prison study" that he conducted in 1971 (Zimbardo, n.d.).

In that study, Zimbardo and his colleagues set up a mock prison. They selected 23 student volunteers and divided them into two groups. One group was chosen to be the "prisoners." They were picked up at their homes by actual police officers, "arrested," and brought to the prison to be guarded by the other group of students—the "guards." The two groups were placed in a setting that was designed to look like a real prison, and the role-play began.

THE ZIMBARDO PRISON STUDY

Watch this video about Zimbardo's study.

The study was expected to run for two weeks. However, on the second day, the prisoners tried to rebel against the guards. The guards quickly moved to stop the rebellion by using both psychological punishment and physical abuse. In the ensuing days, the guards denied the prisoners food, water, and sleep; shot them with fire-extinguisher spray; threw their blankets into the dirt; and stripped them naked. On the fifth night the experimenters witnessed the guards putting bags over the prisoners' heads, chaining their legs, and marching them around. At this point the researchers stopped the experiment early. The conclusions of Zimbardo's research were clear: People may be so profoundly influenced by their social situation that they become coldhearted jail masters who torture their victims.

An Iraqi prisoner being tortured by soldiers at the Abu Ghraib prison. [This work, "Abu Ghraib Prisoner (cropped)," is licensed under CC BY 4.0 by Judy Schmitt. It is a derivative of "Abu Ghraib 17a" by U.S. Department of Defense/Wikimedia Commons, which is in the public domain.]

Zimbardo's research can help us understand the events that occurred at Abu Ghraib. Zimbardo acted as an expert witness in the trial of Staff Sergeant Ivan "Chip" Frederick, who was sentenced to eight years in prison for his role in the abuse at Abu Ghraib. Frederick was the Army reservist who was put in charge of the night shift at Tier 1A, where the detainees were abused. During his trial, Frederick said, "What I did was wrong, and I don't understand why I did it." Zimbardo believes that Frederick acted exactly like the students in the prison study did. He worked in a prison that was overcrowded, filthy, and dangerous, and where he was expected to maintain control over the Iraqi prisoners—in short, the situation he found himself in was very similar to that of Zimbardo's prison study.

In a recent interview, Zimbardo argued (you can tell that he is a social psychologist) that "human behavior is more influenced by things outside of us than inside." He believes that, despite our moral and religious beliefs and despite the inherent goodness of people, there are times when external circumstances can overwhelm us, and we do things we never thought we were capable of doing. He argued that "if you're not aware that this can happen, you can be seduced by evil. We need inoculations against our own potential for evil. We have to acknowledge it. Then we can change it" (Driefus, 2007).

You may wonder whether the extreme behavior of the guards and prisoners in Zimbardo's prison study was unique to the particular social context that he created. Recent research by Stephen Reicher and Alex Haslam (2006) suggests that this is indeed the case. In their research, they recreated Zimbardo's prison experiment while making some small, but important, changes. For one, the prisoners were not "arrested" before the study began, and the setup of the jail was less realistic. Furthermore, the researchers in this experiment told the "guards" and the "prisoners" that the groups were arbitrary and could change over time (that is, that some prisoners might be able to be promoted to guards). The results of this study were entirely different than those found by Zimbardo. Although this study was also stopped early, this was more because the guards felt uncomfortable in their superior position than because the prisoners were being abused.

This "prison" simply did not feel like a real prison to the participants, and as a result they did not take on the roles they were assigned. Again, the conclusions are clear—the specifics of the social situation, more than the people themselves, are often the most important determinants of behavior. ■

use the shock machine. In these situations, there was virtually no shocking. These conditions show that people do not like to harm others, and when given a choice they will not. On the other hand, the social situation can create powerful, and potentially deadly, social influence.

TYPES OF POWER

One of the most influential theories of power was developed by Bertram Raven and John French (French & Raven, 1959; Raven, 1992). Raven identified five different types of power—*reward power*, *coercive power*, *legitimate power*, *referent power*, and *expert power* (shown in TABLE 22.3), arguing that each type of power involves a different type of social influence and that the different types vary in terms of whether their use will create public conformity or private acceptance. Understanding the types of power is important because it allows us to see more clearly the many ways that people can influence others. Let's consider these five types of power, beginning with those that are most likely to produce public conformity only and moving on to those that are more likely to produce private acceptance.

Reward Power

Reward power occurs when one person is able to influence others by providing them with positive outcomes. Bosses have reward power over employees because they are able to increase employees' salary and job benefits, and teachers have reward power over students because they can assign high marks. The variety of rewards that can be used by the powerful is almost endless and includes verbal praise or approval, the awarding of status or prestige, and even direct financial payment.

The ability to wield reward power over those we want to influence is contingent on the needs of the person being influenced. Power is greater when the person being influenced has a strong desire to obtain the reward, and power is weaker when the individual does not need the reward. A boss will have more influence on an employee who has no other job prospects than on one who is being sought after by other corporations, and expensive presents will be more effective in persuading those who cannot buy the items with their own money. Because the change in behavior that results from reward power is driven by the reward itself, its use is usually more likely to produce public conformity than private acceptance.

TABLE 22.3. Types of Power

Reward power	The ability to distribute positive or negative rewards
Coercive power	The ability to dispense punishments
Legitimate power	Authority that comes from a belief on the part of those being influenced that the person has a legitimate right to demand conformity.
Referent power	Influence based on identification with, attraction to, or respect for the power-holder
Expert power	Power that comes from other's beliefs that the power-holder possesses superior skills and abilities

Note. French and Raven (1959) proposed five types of power, which differ in their likelihood of producing public conformity or private acceptance.

Coercive Power

Coercive power is power that is based on the ability to create negative outcomes for others, for instance by bullying, intimidating, or otherwise punishing. Bosses have coercive power over employees if they are able (and willing) to punish employees by reducing their salary, demoting them to a lower position, embarrassing them, or firing them. And friends can coerce each other through teasing, humiliation, and ostracism. As with reward power, coercive power is effective only when the person being influenced is dependent upon the power-holder. Furthermore, coercion works only if the person being influenced does not leave the group entirely—people who are punished too much are likely to look for other situations that provide more positive outcomes.

In many cases power-holders use reward and coercive power at the same time—for instance, by increasing salaries as a result of positive performance but also threatening to reduce them if the performance drops. Because the use of coercion has such negative consequences, authorities are generally more likely to use reward than coercive power (Molm, 1997). Coercion is usually more difficult to use, since it often requires energy to keep the person from avoiding the punishment by leaving the situation altogether. And coercive power is less desirable for both the power-holder and the person being influenced because it creates an environment of negative feelings and distrust that is likely to make interactions difficult, undermine satisfaction, and lead to retaliation against the power-holder (Tepper et al., 2009).

As with reward power, coercive power is more likely to produce public conformity than private acceptance. Furthermore, in both cases the effective use of the power requires that the power-holder continually monitor the behavior of the target to be sure that he or she is complying. This monitoring may itself lead to a sense of mistrust between the two individuals in the relationship. The power-holder feels (perhaps unjustly) that the target is only complying due to the monitoring, whereas the target feels (again perhaps unjustly) that the power-holder does not trust him or her.

Legitimate Power

Whereas reward and coercive power are likely to produce conformity, other types of power, which are not so highly focused around reward and punishment, are more likely to create changes in attitudes as well as behavior (private acceptance). In many ways, then, these sources of power are stronger because they produce real belief change. **Legitimate power** is power vested in those who are appointed or elected to positions of authority, such as teachers, politicians, policemen, and judges, and their power is successful because members of the group accept it as appropriate. We accept that governments can levy taxes and that judges can decide the outcomes of court cases because we see these groups and individuals as valid parts of our society. Individuals with legitimate power can exert substantial influence on their followers. Those with legitimate power may not only create changes in the behavior of others but also have the power to create and change the social norms of the group.

In some cases legitimate power is given to the authority figure as a result of laws or elections, or as part of the norms, traditions, and values of the society. The power that the experimenter had over the research participants in Milgram's study on obedience seems to have been primarily the result of his legitimate power as a respected scientist at an important university. In other cases, legitimate power comes more informally, as a result of being a respected group member. People who contribute to the group process and follow group norms gain status within the group and therefore earn legitimate power.

In some cases, legitimate power can even be used successfully by those who do not seem to have much power. You may recall that after Hurricane Katrina hit the city of New Orleans in 2005, the people there demanded that the federal government help them rebuild the city. Although these people did not have much reward or coercive power, they were nevertheless perceived as good and respected citizens of the United

RESEARCH FOCUS

Does Power Corrupt?

Having power provides some benefits for those who have it. In comparison to those with less power, people who have more power over others are more confident and more attuned to potential opportunities in their environment (Anderson & Berdahl, 2002). They are also more likely than are people with less power to take action to meet their goals (Anderson & Galinsky, 2006; Galinsky et al., 2003).

Despite these advantages of having power, a little power goes a long way and having too much can be dangerous, for both the targets of the power and the power-holder himself or herself. In an experiment by David Kipnis (1972), college students played the role of "supervisors" who were supposedly working on a task with other students (the "workers"). According to random assignment to experimental conditions, one half of the supervisors were able to influence the workers through legitimate power only, by sending them messages attempting to persuade them to work harder. The other half of the supervisors were given increased power. In addition to being able to persuade the workers to increase their output through the messages, they were also given both reward power (the ability to give small monetary rewards) and coercive power (the ability to take away earlier rewards).

Although the workers (who were actually preprogrammed) performed equally well in both conditions, the participants who were given more power took advantage of it by more frequently contacting the workers and more frequently threatening them. The students in this condition relied almost exclusively on coercive power rather than attempting to use their legitimate power to develop positive relations with the subordinates.

Although it did not increase the workers' performance, having the extra power had a negative effect on the power-holders' images of the workers. At the end of the study, the supervisors who had been given extra power rated the workers more negatively, were less interested in meeting them, and felt that the only reason the workers did well was to obtain the rewards.

The conclusion of these researchers is clear: Having power may lead people to use it, even though it may not be necessary, which may then lead them to believe that their subordinates are performing only because of the threats. Although using excess power may be successful in the short run, power that is based exclusively on reward and coercion is not likely to produce a positive environment for either the power-holder or the subordinate. People with power may also be more likely to stereotype people with less power than they have (Dépret & Fiske, 1999) and may be less likely to help other people who are in need (van Kleef et al., 2008).

Although this research suggests that people may use power when it is available to them, other research has found that this is not equally true for all people—still another case of a person-situation interaction. Serena Chen and her colleagues (2001) found that students who had been classified as more self-oriented (in the sense that they considered relationships in terms of what they could and should get out of them for themselves) were more likely to misuse their power, whereas students who were classified as other-oriented were more likely to use their power to help others. ■

States. Many U.S. citizens tend to believe that people who do not have as much as others (for instance, those who are very poor) should be treated fairly and that these people may legitimately demand resources from those who have more. This might not always work, but to the extent that it does it represents a type of legitimate power—power that comes from a belief in the appropriateness or obligation to respond to the requests of others with legitimate standing.

Referent Power

People with **referent power** have an ability to influence others because they can lead those others to identify with them. In this case, the person who provides the influence is (a) a member of an important reference group—someone we personally admire and attempt to emulate; (b) a charismatic, dynamic, and persuasive leader; or (c) a person who is particularly attractive or famous (Heath et al., 1994; Henrich & Gil-White, 2001; Kamins, 1989; Wilson & Sherrell, 1993). A young child who mimics the opinions or behaviors of an older sibling or a famous baseball player, or a churchgoer who follows the advice of a respected church leader, is influenced by referent power. Referent power generally produces private acceptance rather than public conformity (Kelman, 1961).

The influence brought on by referent power may occur in a passive sense because the person being emulated does not necessarily attempt to influence others, and the person who is being influenced may not even realize that the influence is occurring. In other cases, however, the person with referent power (such as the leader of a cult) may make full use of his or her status as the target of identification or respect to produce change. In either case, referent power is a particularly strong source of influence because it is likely to result in the acceptance of the opinions of the important other.

Expert Power

French and Raven's final source of power is **expert power**. Experts have knowledge or information, and conforming to those whom we perceive to be experts is useful for making decisions about issues for which we have insufficient expertise. Expert power thus represents a type of informational influence based on the fundamental desire to obtain valid and accurate information, and where the outcome is likely to be private acceptance. Conformity to the beliefs or instructions of doctors, teachers, lawyers, and computer experts is an example of expert influence; we assume that these individuals have valid information about their areas of expertise, and we accept their opinions based on this perceived expertise (particularly if their advice seems to be successful in solving problems). Indeed, one method of increasing one's power is to become an expert in a domain. Expert power is increased for those who possess more information about a relevant topic than others do because the others must turn to this individual to gain the information. You can see, then, that if you want to influence others, it can be useful to gain as much information about the topic as you can.

LEADERS AND LEADERSHIP

One type of person who has power over others, in the sense that they are able to influence them, is leaders. Leaders are in a position in which they can exert **leadership**, which is the ability to direct or inspire others to achieve goals (Chemers, 2001; Hogg, 2010). Leaders have many different influence techniques at their disposal. In some cases, they may give commands and enforce them with reward or coercive power, resulting in public conformity with the commands. In other cases, they may rely on well-reasoned technical arguments or inspirational appeals, making use of legitimate, referent, or expert power, with the goal of creating private acceptance and leading their followers to achieve.

Leadership is a classic example of the combined effects of the person and the social situation. Let's consider first the person part of the equation and then turn to consider how the person and the social situation work together to create effective leadership.

Personality and Leadership

One approach to understanding leadership is to focus on person variables. **Personality theories of leadership** are explanations of leadership based on the idea that some people are simply "natural leaders" because they possess personality characteristics that make them effective (Zaccaro, 2007).

One personality variable that is associated with effective leadership is intelligence. Being intelligent improves leadership, as long as the leader is able to communicate in a way that is easily understood by his or her followers (Simonton, 1994, 1995). Other research has found that a leader's social skills, such as the ability to accurately perceive the needs and goals of the group members, are also important to effective leadership. People who are more sociable, and therefore better able to communicate with others, tend to make good leaders (Kenny & Zaccaro, 1983; Sorrentino & Boutillier, 1975). Other variables that relate to leadership effectiveness include verbal skills, creativity, self-confidence, emotional stability, conscientiousness, and agreeableness (Cronshaw & Lord, 1987; Judge et al., 2002; Yukl, 2002). And of course the individual's skills at the task at hand are important. Leaders who have expertise in the area of their leadership will be more effective than those who do not.

Because so many characteristics seem to be related to leader skills, some researchers have attempted to account for leadership not in terms of individual traits but in terms of a package of traits that successful leaders seem to have. Some

have considered this in terms of *charisma* (Beyer, 1999; Conger & Kanungo, 1998). **Charismatic leaders** are leaders who are enthusiastic, committed, and self-confident; who tend to talk about the importance of group goals at a broad level; and who make personal sacrifices for the group. Charismatic leaders express views that support and validate existing group norms but that also contain a vision of what the group could or should be. Charismatic leaders use their referent power to motivate, uplift, and inspire others. And research has found a positive relationship between a leader's charisma and effective leadership performance (Simonton, 1988).

Another trait-based approach to leadership is based on the idea that leaders take either *transactional* or *transformational leadership styles* with their subordinates (Avolio & Yammarino, 2003; Podsakoff et al., 1990). *Transactional leaders* are the more regular leaders who work with their subordinates to help them understand what is required of them and to get the job done. *Transformational leaders*, on the other hand, are more like charismatic leaders—they have a vision of where the group is going and attempt to stimulate and inspire their workers to move beyond their present status and to create a new and better future. Transformational leaders are those who can reconfigure or transform the group's norms (Reicher & Hopkins, 2003).

Google Corporation co-founders Sergey Brin (left) and Larry Page (right) are good examples of transformational leaders who have been able to see new visions and motivate their workers to achieve them. [This work, "Brin and Page, May 2008," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Schmidt-Brin-Page-20080520" by Joi Ito/Wikimedia Commons, which is licensed under CC BY 2.0.]

Leadership as an Interaction Between the Person and the Situation

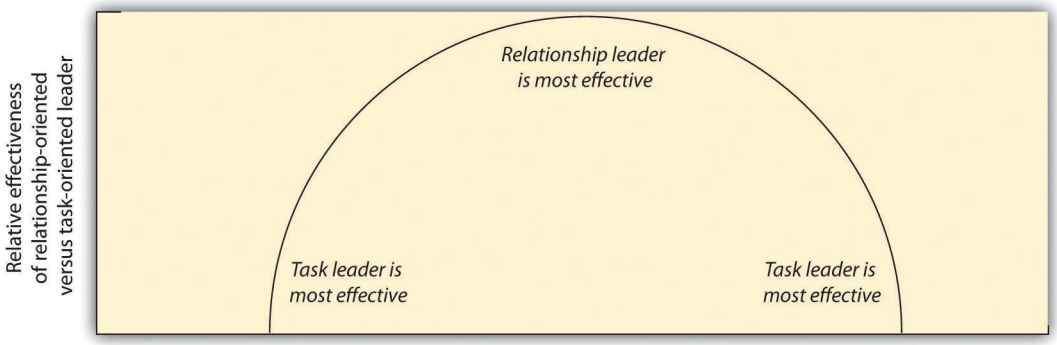
Despite the fact that there appear to be at least some personality traits that relate to leadership ability, the most important approaches to understanding leadership take into consideration both the personality characteristics of the leader and the situation in which the leader is operating. In some cases, the situation itself is important. For instance, you might remember that President George W. Bush's ratings as a leader increased dramatically after the September 11, 2001, terrorist attacks on the World Trade Center. This is a classic example of how a situation can influence the perceptions of a leader's skill. In other cases, however, both the situation and the person are critical.

One well-known person-situation approach to understanding leadership effectiveness was developed by Fred Fiedler and his colleagues (Ayman et al., 1995). The **contingency model of leadership effectiveness** is a model of leadership effectiveness that focuses on both person variables and situational variables. Fiedler conceptualized the leadership style of the individual as a relatively stable personality variable and measured it by having people consider all the people they had ever worked with and describe the person that they least liked to work with (their *least preferred coworker*). Those who indicated that they only somewhat disliked their least preferred coworker are relationship-oriented types of people, who are motivated to have close personal relationships with others. However, those who indicated that they did not like this coworker very much were classified as task-oriented types, who are motivated primarily by getting the job done.

In addition to classifying individuals according to their leadership styles, Fiedler also classified the situations in which groups had to perform their tasks, both on the basis of the task itself and on the basis of the leader's relationship to the group members. Specifically, as shown in **FIGURE 22.2**, Fiedler thought that three aspects of the group situation were important:

1. The degree to which the leader already has a good relationship with the group and the support of the group members (*leader-member relations*)
2. The extent to which the task is structured and unambiguous (*task structure*)
3. The leader's level of power or support in the organization (*position power*)

Furthermore, Fiedler believed that these factors were ordered in terms of their importance, such that leader-member relationships were more important than task structure, which was in turn more important than position power. As a result, he was able to create eight levels of the "situational favorableness" of the group situation, which roughly



	Favorable situational control				Unfavorable situational control			
Leader-member relations	Good	Good	Good	Good	Bad	Bad	Bad	Bad
Task structure	Structure		Unstructure		Structure		Unstructure	
Leader's position of power	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak

FIGURE 22.2. The contingency model of leadership effectiveness. ["The Contingency Model of Leadership Effectiveness" by University of Minnesota is licensed under CC BY-NC-SA 4.0.]

range from most favorable to least favorable for the leader. The most favorable relationship involves good relationships, a structured task, and strong power for the leader, whereas the least favorable relationship involves poor relationships, an unstructured task, and weak leader power.

The contingency model is interactionist because it proposes that individuals with different leadership styles will differ in effectiveness in different group situations. Task-oriented leaders are expected to be most effective in situations in which the group situation is very favorable because this gives the leader the ability to move the group forward, or in situations in which the group situation is very unfavorable and in which the extreme problems of the situation require the leader to engage in decisive action. However, in the situations of moderate favorableness, which occur when there is a lack of support for the leader or when the problem to be solved is very difficult or unclear, the more relationship-oriented leader is expected to be more effective. In short, the contingency model predicts that task-oriented leaders will be most effective either when the group climate is very favorable and thus there is no need to be concerned about the group members' feelings, or when the group climate is very unfavorable and the task-oriented leader needs to take firm control.

Still another approach to understanding leadership is based on the extent to which a group member embodies the norms of the group. The idea is that people who accept group norms and behave in accordance with them are likely to be seen as particularly good group members and therefore become leaders (Hogg, 2001; Hogg & van Knippenberg, 2003). Group members who follow group norms are seen as more trustworthy (Dirks & Ferrin, 2002) and are likely to engage in group-oriented behaviors to strengthen their leadership credentials (Platow & van Knippenberg, 2001).

KEY TAKEAWAYS

- Social power can be defined as the ability of a person to create conformity, even when the people being influenced may attempt to resist those changes.
- Milgram's studies on obedience demonstrated the remarkable extent to which the social situation and people with authority have the power to create obedience.
- One of the most influential theories of power was developed by French and Raven, who identified five different types of power—reward power, coercive power, legitimate power, referent power, and expert power. The types vary in terms of whether their use is more likely to create public conformity or private acceptance.
- Although power can be abused by those who have it, having power also creates some positive outcomes for individuals.
- Leadership is determined by person variables, situational variables, and by the person-situation interaction. The contingency model of leadership effectiveness is an example of the latter.

EXERCISES AND CRITICAL THINKING

1. Write a paragraph that expresses your opinions about the Holocaust or about another example of obedience to authority. Consider how social psychological research on obedience informs your interpretation of the event.
2. Write a report on Dr. Philip Zimbardo's book, *The Lucifer Effect: Understanding How Good People Turn Evil*, http://lucifereffect.com.
3. Provide an example of someone who has each of the types of power discussed in this section.
4. Consider a leader whom you have worked with in the past. What types of leadership did that person use? Were they effective?
5. Choose a recent event that involved a very effective leader or one that involved a very poor one. Analyze the leadership in terms of the topics discussed in this chapter.

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READING 23

How the Social Context Influences Helping

SOURCE

University of Minnesota. (2015). *Principles of social psychology.* University of Minnesota Libraries Publishing.
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LEARNING OBJECTIVE

- Review Bibb Latané and John Darley's model of helping behavior and indicate the social psychological variables that influence each stage.

KEY TERMS

diffusion of responsibility

pluralistic ignorance

Although emotional responses such as guilt, personal distress, and empathy are important determinants of altruism, it is the social situation itself—the people around us when we are deciding whether or not to help—that has perhaps the most important influence on whether and when we help.

Consider the unusual case of the killing of 28-year-old Katherine "Kitty" Genovese in New York City at about 3:00 a.m. on March 13, 1964. Her attacker, Winston Moseley, stabbed and sexually assaulted her within a few yards of her apartment building in the borough of Queens. During the struggle with her assailant, Kitty screamed, "Oh my God! He stabbed me! Please help me!" But no one responded. The struggle continued; Kitty broke free from Moseley, but he caught her again, stabbed her several more times, and eventually killed her.

The murder of Kitty Genovese shocked the nation, in large part because of the (often inaccurate) reporting of it. Stories about the killing, in the *New York Times* and other papers, indicated that as many as 38 people had overheard the struggle and killing, that none of them had bothered to intervene, and that only one person had even called the police, long after Genovese was dead.

Although these stories about the lack of concern by people in New York City proved to be false (Manning et al., 2007), they nevertheless led many people to think about the variables that might lead people to help or, alternatively, to be insensitive to the needs of others. Was this an instance of the uncaring and selfish nature of human beings? Or was there something about this particular social situation that was critical? It turns out, contrary to your expectations I would imagine, that having many people around during an emergency can in fact be the opposite of helpful—it can reduce the likelihood that anyone at all will help.

LATANÉ AND DARLEY'S MODEL OF HELPING

Two social psychologists, Bibb Latané and John Darley, found themselves particularly interested in, and concerned about, the Kitty Genovese case. As they thought about the stories that they had read about it, they considered the nature of emergency situations such as this one. They realized that emergencies are unusual and that people frequently do not really know what to do when they encounter one. Furthermore, emergencies are potentially dangerous to the helper, and it is therefore probably pretty amazing that anyone helps at all.

To better understand the processes of helping in an emergency, Latané and Darley developed a model of helping that took into consideration the important role of the social situation. Their model, which is shown in **FIGURE 23.1**, has been extensively tested in many studies, and there is substantial support for it.

Noticing

Latané and Darley thought the first thing that had to happen in order for people to help is that they had to notice the emergency. This seems pretty obvious, but it turns out that the social situation has a big impact on noticing an emergency. Consider, for instance, people who live in a large city such as New York City, Bangkok, or Beijing. These cities are big, noisy, and crowded—it seems like there are a million things going at once. How could people living in such a city even notice, let alone respond to, the needs of all the people around them? They are simply too overloaded by the stimuli in the city (Milgram, 1970).

Many studies have found that people who live in smaller and less dense rural towns are more likely to help than those who live in large, crowded, urban cities (Amato, 1983; Levine et al., 1994). Although there are a lot of reasons for such

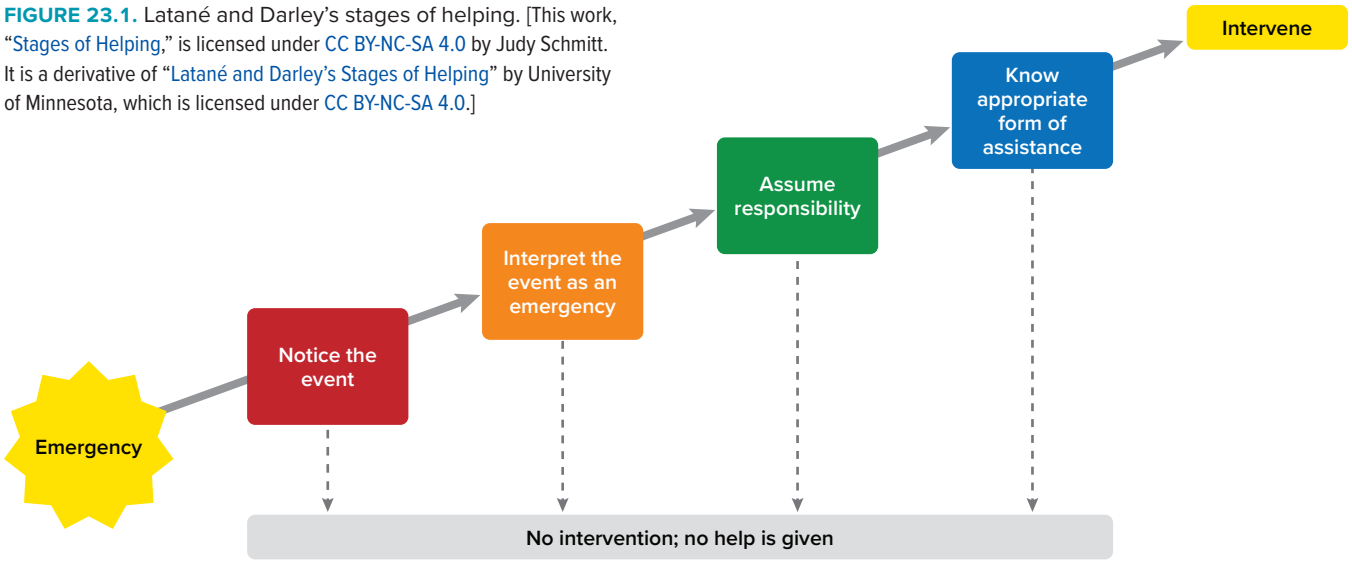

FIGURE 23.1. Latané and Darley's stages of helping. [This work, "Stages of Helping," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Latané and Darley's Stages of Helping" by University of Minnesota, which is licensed under CC BY-NC-SA 4.0.]

differences, just noticing the emergency is critical. When there are more people around, it is less likely that people notice the needs of others.

You may have had an experience that demonstrates the influence of the social situation on noticing. Imagine that you have lived with a family or a roommate for a while, but one night you find yourself alone in your house or apartment because your housemates are staying somewhere else that night. If you are like me, I bet you find yourself hearing sounds that you never heard before—and they might make you pretty nervous. Of course the sounds have always been there, but when other people are around you, you are simply less alert to them. The presence of others can divert our attention from the environment—it's as if we are unconsciously, and probably quite mistakenly, counting on the others to take care of things for us.

Latané and Darley (1968) wondered if they could examine this phenomenon experimentally. To do so, they simply asked their research participants to complete a questionnaire in a small room. Some of the participants completed the questionnaire alone, while others completed the questionnaire in small groups in which two other participants were also working on questionnaires.

A few minutes after the participants had begun the questionnaires, the experimenters started to release some white smoke into the room through a vent in the wall while they watched through a one-way mirror. The smoke got thicker as time went on, until it filled the room. The experimenters timed how long it took before the first person in the room looked up and noticed the smoke. The people who were working alone noticed the smoke in about 5 seconds, and within 4 minutes most of the participants who were working alone had taken some action. But what about the participants working in groups of three? Although we would certainly expect that having more people around would increase the likelihood that someone would notice the smoke, on average, the first person in the group conditions did not notice the smoke until over 20 seconds had elapsed. And although 75% of the participants who were working alone reported the smoke within 4 minutes, the smoke was reported in only 12% of the three-person groups by that time. In fact, in only three of the eight three-person groups did anyone report the smoke at all, even after it had entirely filled the room!

Interpreting

Even if we notice an emergency, we might not interpret it as one. The problem is that events are frequently ambiguous, and we must interpret them to understand what they really mean. Furthermore, we often don't see the whole event unfolding, so it is difficult to get a good handle on it. Is a man holding an iPod and running away from a group of pursuers a criminal who needs to be apprehended, or is this just a harmless prank? Were the cries of Kitty Genovese really calls for help, or were they simply an argument with a boyfriend? It's hard for us to tell when we haven't seen the whole event (Piliavin et al., 1976). Moreover, because emergencies are rare and because we generally tend to assume that events are benign, we may be likely to treat ambiguous cases as not being emergencies.

The problem is compounded when others are present because when we are unsure how to interpret events we normally look to others to help us understand them (this is informational social influence). However, the people we are looking toward for understanding are themselves unsure how to interpret the situation, and they are looking to us for information at the same time we are looking to them.

When we look to others for information we may assume that they know something we do not know. This is often a mistake, because all the people in the situation are doing the same thing. None of us really know what to think, but at the same time we assume that the others do know. **Pluralistic ignorance** occurs when people think others in their environment have information they do not have and when they base their judgments on what they think the others are thinking.

Pluralistic ignorance seems to have been occurring in Latané and Darley's studies, because even when the smoke became really heavy in the room, many people in the group conditions did not react to it. Rather, they looked at each other, and because nobody else in the room seemed very concerned, they each assumed that the others thought that everything was all right. You can see the problem—each bystander thinks that other people aren't acting because they don't see an emergency. Of course, everyone is confused, but believing that the others know something that they don't, each observer concludes that help is not required.

Pluralistic ignorance is not restricted to emergency situations (Miller et al., 1988; Suls & Green, 2003). Maybe you have had the following experience: You are in one of your classes and the instructor has just finished a complicated explanation. He is unsure whether the students are up to speed and asks, "Are there any questions?" All the class members are of course completely confused, but when they look at each other, nobody raises a hand in response. So everybody in the class (including the instructor) assumes that everyone understands the topic perfectly. This is pluralistic ignorance at its worst—we are all assuming that others know something that we don't, and so we don't act. The moral to instructors in this situation is clear: Wait until at least one student asks a question. The moral for students is also clear: Ask your question! Don't think that you will look stupid for doing so—the other students will probably thank you.

Taking Responsibility

Even if we have noticed the emergency and interpret it as being one, this does not necessarily mean that we will come to the rescue of the other person. We still need to decide that it is our responsibility to do something. The problem is that when we see others around, it is easy to assume that they are going to do something and that we don't need to do anything. **Diffusion of responsibility** occurs when we assume that others will take action and therefore we do not take action ourselves. The irony of course is that people are more likely to help when they are the only ones in the situation than they are when there are others around.

Darley and Latané (1968) had study participants work on a communication task in which they were sharing ideas about how to best adjust to college life with other people in different rooms using an intercom. According to random assignment to conditions, each participant believed that he or she was communicating with either one, two, or five other people, who were in either one, two, or five other rooms. Each participant had an initial chance to give his opinions over the intercom, and on the first round one of the other people (actually a confederate of the experimenter) indicated that he had an "epileptic-like" condition that had made the adjustment process very difficult for him. After a few minutes, the subject heard the experimental confederate say,

> I-er-um-I think I-I need-er-if-if could-er-er-somebody er-er-er-er-er-er-er give me a liltle-er-give me a little help here because-er-I-er-I'm-er-er having a-a-a real problcm-er-right now and I-er-if somebody could help me out it would-it would-er-er s-s-sure be-sure be good . . . because there-er-er-a cause I-er-I-uh-I've got a-a one of the-er-sei er-er-things coming on and-and-and I could really-er-use some help so if somebody would-er-give me a little h-help-uh-er-er-er-er-er c-could somebody-er-er-help-er-uh-uh-uh (choking sounds). . . . I'm gonna die-er-er-I'm . . . gonna die-er-help-er-er-seizure-er- (chokes, then quiet). (Darley & Latané, 1968, p. 379)

As you can see in **TABLE 23.1**, the participants who thought that they were the only ones who knew about the emergency (because they were only working with one other person) left the room quickly to try to get help. In the larger groups, however, participants were less likely to intervene and slower to respond when they did. Only 31% of the participants in the largest groups responded by the end of the 6-minute session.

You can see that the social situation has a powerful influence on helping. We simply don't help as much when other people are with us.

Perhaps you have noticed diffusion of responsibility if you have participated in an Internet users group where people asked questions of the other users. Did you find that it was easier to get help if you directed your request to a smaller set of users than when you directed it to a larger number of people? Consider the following: In 1998, Larry Froistad, a 29-year-old computer programmer, sent the following message to the members of an Internet self-help group that

TABLE 23.1. Effects of Group Size on Likelihood and Speed of Helping

Group Size	Average Helping (%)	Average Time to Help (in seconds)
2 (participant and victim)	85	52
3 (participant, victim, and 1 other)	62	93
6 (participant, victim, and 4 others)	31	166

Source: Darley and Latané (1968).

had about 200 members. "Amanda I murdered because her mother stood between us . . . when she was asleep, I got wickedly drunk, set the house on fire, went to bed, listened to her scream twice, climbed out the window and set about putting on a show of shock and surprise." Despite this clear online confession to a murder, only three of the 200 newsgroup members reported the confession to the authorities (Markey, 2000).

To study the possibility that this lack of response was due to the presence of others, the researchers (Markey, 2000) conducted a field study in which they observed about 5,000 participants in about 400 different chat groups. The experimenters sent a message to the group, from either a male (JakeHarmen) or female (SuzyHarmen) screen name. Help was sought by either asking all the participants in the chat group, "Can anyone tell me how to look at someone's profile?" or by randomly selecting one participant and asking "[name of selected participant], can you tell me how to look at someone's profile?" The experimenters recorded the number of people present in the chat room, which ranged from 2 to 19, and then waited to see how long it took before a response was given.

It turned out that the gender of the person requesting help made no difference, but that addressing to a single person did. Assistance was received more quickly when help was asked for by specifying a participant's name (in only about 37 seconds) than when no name was specified (51 seconds). Furthermore, a correlational analysis found that when help was requested without specifying a participant's name, there was a significant negative correlation between the number of people currently logged on in the group and the time it took to respond to the request.

Garcia et al. (2002) found that the presence of others can promote diffusion of responsibility even if those other people are only imagined. In these studies, the researchers had participants read one of three possible scenarios that manipulated whether participants thought about dining out with 10 friends at a restaurant (*group condition*) or whether they thought about dining at a restaurant with only one other friend (*one-person condition*). Participants in the group condition were asked to "Imagine you won a dinner for yourself and 10 of your friends at your favorite restaurant." Participants in the one-person condition were asked to "Imagine you won a dinner for yourself and a friend at your favorite restaurant."

After reading one of the scenarios, the participants were then asked to help with another experiment supposedly being conducted in another room. Specifically, they were asked: "How much time are you willing to spend on this other experiment?" At this point, participants checked off one of the following minute intervals: *0 minutes*, *2 minutes*, *5 minutes*, *10 minutes*, *15 minutes*, *20 minutes*, *25 minutes*, and *30 minutes*.

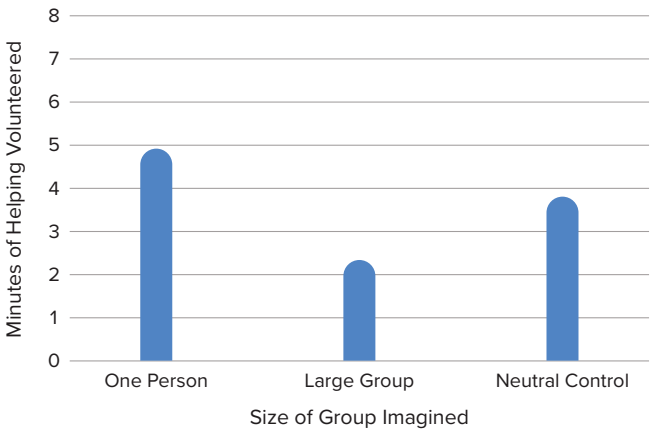

FIGURE 23.2. Helping as a function of imagined social context. Garcia et al. (2002) found that the presence of others reduced helping, even when those others were only imagined. [This work, "Helping and Imagined Social Context," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Helping as a Function of Imagined Social Context" by University of Minnesota, which is licensed under CC BY-NC-SA 4.0.]

As you can see in **FIGURE 23.2**, simply imagining that they were in a group or alone had a significant effect on helping, such that those who imagined being with only one other person volunteered to help for more minutes than did those who imagined being in a larger group.

Implementing Action

The fourth step in the helping model is knowing how to help. Of course, for many of us the ways to best help another person in an emergency are not that clear; we are not professionals and we have little training in how to help in emergencies. People who do have training in how to act in emergencies are more likely to help, whereas the rest of us just don't know what to do and therefore may simply walk by. On the other hand, today most people have cell phones, and we can do a lot with a quick call. In fact, a phone call made in time might have saved Kitty Genovese's life. The moral: You might not know exactly what to do, but you may well be able to contact someone else who does.

Latané and Darley's decision model of bystander intervention has represented an important theoretical framework for helping us understand the role of situational variables on helping. Whether or not we help depends on the outcomes of a series of decisions that involve noticing the event, interpreting the situation as one requiring assistance, deciding to take personal responsibility, and deciding how to help.

Fischer et al. (2011) analyzed data from over 105 studies using over 7,500 participants who had been observed helping (or not helping) in situations in which they were alone or with others. The researchers found significant support for the idea that people helped more when fewer others were present.

And, supporting the important role of interpretation, they also found that the differences were smaller when the need for helping was clear and dangerous and thus required little interpretation. They also found that there were at least some situations (such as when bystanders were able to help provide needed physical assistance) in which having other people around increased helping.

Although the Latané and Darley model was initially developed to understand how people respond in emergencies requiring immediate assistance, aspects of the model have been successfully applied to many other situations, ranging from preventing someone from driving drunk to making a decision about whether to donate a kidney to a relative (Schroeder et al., 1995).

KEY TAKEAWAYS

- The social situation has an important influence on whether or not we help.
- Latané and Darley's decision model of bystander intervention has represented an important theoretical framework for helping us understand the role of situational variables on helping. According to the model, whether or not we help depends on the outcomes of a series of decisions that involve noticing the event, interpreting the situation as one requiring assistance, deciding to take personal responsibility, and implementing action.
- Latané and Darley's model has received substantial empirical support and has been applied not only to helping in emergencies but to other helping situations as well.

EXERCISES AND CRITICAL THINKING

1. Analyze the Kitty Genovese incident in terms of the Latané and Darley model of helping. Which factors do you think were most important in preventing helping?
2. Recount a situation in which you did or did not help, and consider how that decision might have been influenced by the variables specified in Latané and Darley's model.

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READING 24

Other Determinants of Helping

SOURCE

University of Minnesota. (2015). *Principles of social psychology.* University of Minnesota Libraries Publishing.
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LEARNING OBJECTIVES

- Review the person, gender, and cultural variables that relate to altruism.
- Explain how the reactions of the person being helped may influence the benefits of helping.
- Outline the ways that we might be able to increase helping.

KEY TERMS

altruistic or prosocial personality

just world beliefs

Although we have discussed many of the most important factors, there are still other variables that determine our willingness to help others. These include characteristics of the people who are potentially providing help as well as the ways that others respond to the help they may receive. Let us consider them now.

SOME PEOPLE ARE MORE HELPFUL THAN OTHERS: THE ALTRUISTIC PERSONALITY

We have seen that the social situation is a very strong determinant of whether or not we help. But although the effects of personality may not generally be as strong as those of the social context, person variables do matter. Some people are indeed more helpful than others across a variety of situations, and we say that these people have an **altruistic or prosocial personality** (Penner et al., 1995). Try evaluating yourself according to the statements posed in TABLE 24.1 to see how you stand on this variable.

TABLE 24.1. Measuring the Altruistic Personality

Social Responsibility
No matter what a person has done to us, there is no excuse for taking advantage of them.
It makes sense to be very concerned about how we act when we are sick and feeling miserable.
Empathy
I sometimes try to understand my friends better by imagining how things look from their perspective.
When I'm upset at someone, I usually try to "put myself in their shoes" for a while.
Moral Reasoning
My decisions are usually based on my concern for other people.
My decisions are usually based on what is the most fair and just way to act.
I have helped carry a stranger's belongings (e.g., books, parcels, etc.).
I have allowed someone to go ahead of me in a line (e.g., supermarket, copying machine, etc.)

The altruistic personality involves both the cognitive and the emotional responses that we experience around others. People with altruistic personalities tend to show empathy and sympathy for others and feel that it is appropriate and right to follow the norm of social responsibility. These people help more people in a wider variety of areas, including providing help to coworkers, donating organs, and volunteering, and also have been found to help more quickly than do people who score lower on these measures (Borman et al., 2001; Penner, 2002). A longitudinal study conducted by Nancy Eisenberg and her colleagues (1999) found that children who were the most helpful when they were measured in their preschool classes also were the most helpful later in childhood and in early adulthood, suggesting that they really were helpful people. People with altruistic personalities seem to be people who have a strong other-concern—they like to be with, to relate to, and to help others.

The altruistic personality is in part heritable. Research has found that identical twins are more similar to each other in both their helping-related emotions (such as empathy) and their actual helping than are fraternal twins, who share only a portion of their genetic makeup (Davis et al., 1994).

GENDER DIFFERENCES IN HELPING

You may have already asked yourself an important question about helping: Do men or women help more? And perhaps you have answered this question. For instance, you might have decided that women would be more helpful because

they are by and large more attuned to the needs of others. Or perhaps you decided that men would be more helpful because helping involves demonstrating bravery and heroicism and men are more likely to desire to be heroes, or at least to look heroic in the eyes of other people.

In fact, on average there are no big differences between men and women in terms of their helping. For instance, in a survey of altruism sponsored by Independent Sector, an established coalition that studies and encourages volunteering, the percentage of women volunteering (46%) was not significantly different than the percentage of men (42%). Rather, there appears to be a person-by-situation interaction, such that gender differences show up more strongly in some situations than in others. The differences depend not only upon the opportunity to help but also on the type of helping that is required (Becker & Eagly, 2004). In general, men are more likely to help in situations that involve physical strength. If you remember photos and videos taken immediately after the World Trade Center attack in 2001, you'll probably recall the many images of firefighters and police officers, who were primarily men, engaged in heroic acts of helping.

This does not mean that women are any less helpful—in fact, thousands of women helped during and after the World Trade Center attack by tending to the wounded in hospitals, donating blood, raising money for the families of the victims, and helping with cleanup of the disaster sites. Because women are, on average, more focused on other-concern, they are more likely than men to help in situations that involve long-term nurturance and caring, particularly within close relationships. Women are also more likely than men to engage in community behaviors, such as volunteering in the community or helping families (Becker & Eagly, 2004; Eagly & Becker, 2005). Helping within the family is done in large part by mothers, sisters, wives, and female friends. (You might ask yourself when you last received a thank-you note from a man!)

Although this type of helping might be less likely to be rewarded with newspaper stories and medals, providing social support and helping connect people serves to help us meet the important goal of relating to others and thus helps improve the quality of our lives. And women are not afraid to help in situations that are dangerous. In fact, women have been found to be as likely as men are to engage in dangerous behaviors such as donating a kidney to others (Becker & Eagly, 2004).

SOCIAL PSYCHOLOGY IN THE PUBLIC INTEREST

Are the Religious More Altruistic?

Do you think that religious people are more helpful than are people who are less religious? There are plenty of reasons to think this might be so. After all, every major religion preaches the importance of compassion and helpfulness, and many faith-based organizations help the poor and disadvantaged every year. Religious organizations help provide education, food, clothes, financial support, and other essentials to the needy across the globe.

There is support, based on surveys and questionnaires, that religious people do indeed report being more helpful than the less religious (Penner, 2002). For instance, Morgan (1983) found that people who reported that they prayed more often also said that they were more good, friendly, and cooperative toward others. Furrow et al. (2004) found a significant positive relationship between religiousness and prosocial concerns such as empathy, moral reasoning, and responsibility in urban high school students. And Benson et al. (1989) found that adolescents who said they were more religious were also more likely to have been involved in a volunteer service project in the last year.

Batson and his colleagues (1989) wondered if religious people were actually more likely to help or if they simply indicated that they would be on questionnaires. To test this question, they recruited college students and first asked them to report on their religious beliefs. On the basis of these responses, Batson categorized the students into one of four groups:

- The *nonreligious* students were those who did not indicate much interest in religion.
- The *externally religious* students were those who primarily indicated that they used religion for self-concern, such as for feeling more comfortable and being comforted by others, for gaining social status, and for finding support for one's chosen way of life. The externally religious tended to agree with such statements as "The church is most important as a place to formulate good social relationships" and "What religion offers me most is comfort when sorrows and misfortune strike."
- The *internally religious* were those who indicated that they had accepted religion and that it was part of their inner experiences. The internally religious agreed with statements such as "I try hard to carry my religion over into all my other dealings in life" and "Quite often I have been keenly aware of the presence of God or the Divine Being."
- Finally, people who agreed with such statements as "It might be said that I value my religious doubts and uncertainties" and "Questions are far more central to my religious experience than are answers" were considered to be *quest-oriented*. These students see

religion as a lifelong commitment to getting answers to important moral and religious questions.

Then Batson and his colleagues asked the participants whether or not they would be willing to volunteer their time by helping a woman in need or by walking in a walkathon for a charity. However, in each case Batson also gave one half of the participants a possible excuse for not helping, by informing them that a number of other students had already volunteered to help the woman or that they would have to complete a difficult physical exam before they could be in the walkathon.

The researchers found that the externally religious were not more likely to help overall and were actually less likely to help when there was an easy excuse not to. It seems that the externally religious were not really altruistic at all. The internally religious participants seemed somewhat more altruistic—they helped more when the helping was easy, but they did not continue to help when the task got difficult. However, Batson and his team found that the quest-oriented students were the true altruists—they volunteered to help even when doing so required engaging in some difficult exercise and continued to help even when there was an easy excuse not to.

Although most studies investigating the role of religion on altruism have been correlational, there is also some experimental research showing that activating symbols relating to religion causes increased altruism. Shariff and Norenzayan (2007) showed their research participants religious words such as divine, God, sacred, and prophet and then later asked them to contribute some money to a charity. The participants who had seen the religious words were more likely to donate money to an anonymous recipient than were a control group of people who had been exposed to nonreligious control words. However, religion was not the only concept that increased helping. Similar increases in altruism were found when people were shown words related to civil duty, such as civic, jury, court, police, and contract.

In summary, when surveyed, religious people say that they are more helpful than are the nonreligious, but whether they really help when helping conflicts with self-interest seems to depend on what type of religious person they are. People who are religious for personal reasons related to self-concern generally are not more helpful. On the other hand, those who are more quest-oriented—those who really believe that helping is an important part of religious experience—are likely to help even when doing so requires effort. Furthermore, religion is not the only thing that makes us helpful. Being reminded of other social norms, such as our civil responsibility to others, also makes us more helpful. ■

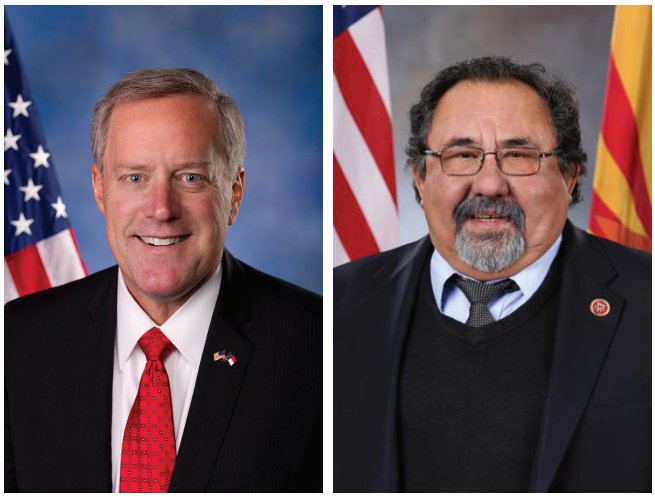
WHO DO WE HELP? ATTRIBUTIONS AND HELPING

We do not help everyone equally—some people just seem to be more worthy of help than others. Our cognitions about people in need matter as do our emotions toward them. For one, our perception of the amount of the need is important. Bickman and Kamzan (1973) found that people were considerably more reluctant to help someone requesting money in a grocery store to buy some cookie dough (a relative luxury item) than they were to help someone requesting money to buy milk (which seems more necessary).

In addition to attempting to determine whether the help is really needed, we also tend to determine whether people are deserving of the help. We tend to provide less help to people who seem to have brought on their problems themselves or who don't seem to be working very hard to solve them on their own than we do to people who need help as a result of events that seem to be out of their control. Imagine, for instance, that a student in your class asks to borrow your class notes to prepare for an exam. And then imagine if the student said, "I just can't take good notes—I attend every class, and I really try, but I just can't do it." I'm guessing that you might be willing to help this student. On the other hand, imagine that the student said, "Well, I miss class a lot because I don't feel like coming, and even when I'm here I don't bother to take notes every day." I bet you'd be less likely to help this person, who doesn't seem to be trying very hard.

Supporting this idea, Dooley (1995) had students read scenarios about a person who had been diagnosed with AIDS. Participants who learned that the person had contracted the disease through a blood transfusion felt more empathy and pity for the person, and also expressed a greater desire to help them, than did participants who believed that the disease was caused by unprotected sex or by illicit drug use. One reason we may be particularly likely to help victims of hurricanes and other natural disasters, then, is that we see that these people did not cause their own problems. Those who do argue against helping these victims may well take the opposite position because they believe that the individuals deserved what they got ("they should have known better than to live there.")

It has been argued that a fundamental difference between individuals who hold politically conservative views and those who hold politically liberal views is how they perceive the necessity or moral responsibility of helping others, and that this relates to how they perceive the causes of people's outcomes. Consider people who appear to need help because they have inadequate food, shelter, or health care, for example. Liberals tend to attribute these outcomes more externally, blaming them on unjust social practices and societal



Political conservatives, such as U.S. Representative Mark Meadows of North Carolina, tend to believe that people deserve what they get and that the federal government should not spend money on health care and other social programs. Liberals, on the other hand, such as U.S. Representative Raúl Grijalva of Arizona, tend to blame poverty and inequality on external factors such as unjust social practices. They are more likely to promote policies designed to help the needy. ["Mark Meadows, Official Portrait, 113th Congress" by U.S. Government/Wikimedia Commons (left) and "Raul Grijalva Official Portrait, 2015" by U.S. Congress/Wikimedia Commons (right) are in the public domain.]

structures that create inequalities. Because they are likely to believe that the people do not deserve their unfortunate situation, they are likely to favor spending on social programs designed to help these people. Conservatives, on the other hand, are more likely to hold **just world beliefs**—beliefs that people get what they deserve in life (Lerner, 1980). Conservatives make more internal attributions for negative outcomes, believing that the needs are caused by the lack of effort or ability on the part of the individual. They are therefore less likely than liberals to favor government spending on welfare and other social programs designed to help people (Kluegel & Smith, 1986; Skitka, 1999).

REACTIONS TO RECEIVING HELP

To this point in the chapter we have proceeded as if helping is always a good thing—that people need to receive help and that they are appreciative of and thankful to the people who help them. But perhaps this is not always true. We haven't yet considered the cognitive and affective reactions of the people who are *receiving* the help. Can you remember a time when somebody tried to help you make a decision or perform a task, but you didn't really want the help? How did that make you think and feel about yourself? Maybe there are costs involved in receiving help, just as there are in giving it.

Although people who receive help often really need the help and may indeed feel appreciative and grateful to those who help them, receiving help may also have some negative consequences. When we help another person, it indicates that we have enough resources that we can afford to give some of them to the recipient; it also indicates that the recipient is dependent on our goodwill. Thus, helping creates a status disparity in the sense that the helper is seen as having higher status than the person being helped. This inequality makes giving help an indication of high status and power, and receiving help a potentially self-threatening experience for the recipient (Nadler, 2002; Nadler & Halabi, 2006). There are a variety of emotions that help recipients might feel in these cases, including embarrassment and worry that they are, or are seen as, incompetent or dependent (DePaulo et al., 1981; Nadler et al., 1983). Research has found that people frequently respond negatively when they receive help and may in some cases even prefer to endure hardships rather than to seek out help (Nadler, 1991). Receiving help, then, can be a potential blow to our self-esteem.

The negative feelings that we experience when receiving help are likely to be particularly strong when the recipient feels that the implication of the helping is that they are unable to care for themselves. In these cases, the help is perceived as being *dependency oriented* (Nadler et al., 1983). When the helper takes control of the situation and solves the problem facing the individual, leaving little left for the individual to accomplish on his or her own, the behavior may be seen as indicating that the individual cannot help herself. The potential recipients of help are likely to reject offers of dependency-oriented help, refrain from seeking it, and react negatively when it is offered.

Another situation in which people may not appreciate the help they are receiving is when that help comes on the basis of one's presumed need. For instance Blaine et al. (1995) found that people who imagined that they had been hired for a job because they were disabled experienced lower self-esteem and felt that they were less likely to work hard on the job than those who imagined that they were hired on the basis of their job qualifications. You can see that government programs, such as those based on affirmative action, although likely to be helpful for the people who receive them, may also lead those people to feel dependent on others.

In contrast to dependency-oriented help, *autonomy-oriented help* is partial and temporary and provides information to the other, for instance, by giving instructions or guidance or providing ideas about how to help oneself. Autonomy-oriented help reflects the helper's view that, given the appropriate tools, recipients can help themselves (Brickman et al., 1982). Autonomy-oriented help allows help recipients to retain their independence despite their reliance on the more resourceful helper. This type of help is less likely to clash with help recipients' view of themselves as capable people who can help themselves.

There are also observed gender differences in the willingness to seek help. Boys and men are less likely to ask for help overall, perhaps in part because they feel that asking for help indicates to others that they are less capable of handling their own affairs or that they have low status (Addis & Mahalik, 2003; Mansfield et al., 2003).

In short, when we help others we must be careful that we do it in a way that allows them to maintain their independence and that reminds them that they are still able to help themselves. This type of help will be more easily accepted and more beneficial in the long run.

CULTURAL ISSUES IN HELPING

Although almost every culture has a social responsibility norm, the strength of those norms varies across cultures. And these differences relate well to what we know about individualism and collectivism. In one study, Miller et al. (1990) found that children and adults in the United States (a Western and therefore individualistic culture) were less likely than children and adults in India (an Eastern and therefore collectivistic culture) to believe that people have an obligation to provide assistance to others. The Indian respondents believed that there was an absolute requirement to help, whereas the Americans offered their help more selectively, even to their friends. Similarly, Baron and Miller (2000) found that Indian students were more likely than U.S. students to view donating bone marrow to save someone's life as morally required, whereas U.S. students were more likely than Indian students to say that donating was a decision that the potential donor had to make himself or herself.

Perlow and Weeks (2002) found that there were substantial cultural differences in the behavior of software engineers working at similar companies and doing the same type of work in the United States and in India. Engineers at the American site were more focused on exchange and reciprocity—they tended to provide help to others only if they thought those people could be helpful to them in the future. The engineers at the Indian company, on the other hand, were more willing to help anyone who seemed to need help, regardless of the potential for a return. Perlow and Weeks interpreted these differences in terms of different ways of meeting the goal of self-interest. Among the Americans, helping was seen as an unwanted interruption on the time of the individual, and thus helping was not personally beneficial. At the Indian company, however, helping was seen more as an opportunity for improving one's skills by helping. These results suggest that helping, at least in Western contexts such as the United States, can be increased if it is framed to be perceived as important toward achieving one's goals.

One important difference between Eastern and Western cultures is that the importance of self-concern (versus other-concern) is higher in the latter. In fact, the strong individualistic norms in cultures such as the United States make it sometimes inappropriate to try to help in cases where we do not have a personal interest. Rebecca Ratner and Dale Miller (2001) had participants read a scenario in which a governmental funding agency was planning to reduce funding for research regarding a disease. The disease was said to affect only women or only men. Then the participants were asked to indicate both whether they were opposed to the reduction in funding and how comfortable they would be in attending a meeting to protest the funding changes.

In terms of their attitudes toward the reduction in funding, there were no significant gender differences. Men thought that the funding should be maintained even when the disease only affected women, and vice versa. However, as you can see in **FIGURE 24.1**, when asked how comfortable they would feel attending a meeting protesting the funding decreases, significant differences occurred. The men predicted that they would feel less comfortable attending a meeting to protest the funding reductions when the disease only affected women, and the women predicted that they would feel less comfortable attending a meeting to protest the funding reductions when the disease only affected men.

Ratner and Miller argued that in Western cultures there is a norm of self-interest that influences whether or not we feel that we can be involved in actions designed to help others. In short, people are not expected to volunteer for, or to be involved in, causes that do not affect them personally. It

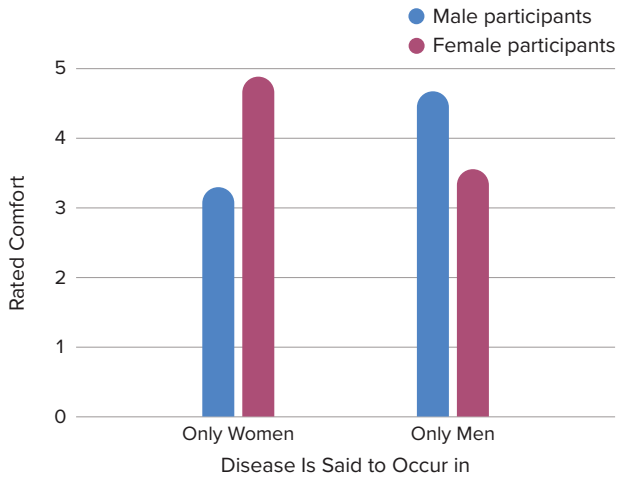


FIGURE 24.1. Effects of standing on feelings of comfort in taking action. This figure represents participants' ratings of how comfortable they would be attending a meeting supporting the attempt to prevent funding reductions for a disease. Suggesting that a norm of self-interest is necessary to get involved, both men and women were less likely to feel comfortable arguing for a position that does not influence them personally. [This work, "Self-Interest and Social Action," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Effects of Standing on Feelings of Comfort in Taking Action" by University of Minnesota, which is licensed under CC BY-NC-SA 4.0. Data from Ratner and Miller (2001, Experiment 3).

is simply inappropriate to lend help to others unless the person is personally involved in the issue and thus stands to benefit. Indeed, participants in another study by Ratner and Miller reacted more negatively to an individual's altruistic behaviors when they did not appear consistent with his or her self-interest.

There is still another example of the subtle role of self-interest in helping. Did you ever notice that many people who are looking for contributions to a cause do not ask directly but rather ask that you purchase something from them, allowing them to keep the profit from the sale? Bake sales, car washes, and address sticker and magazine subscription charity campaigns are all examples of this. Of course, it would be more profitable for the charity if people simply gave the same amount of money rather than taking the gift—and perhaps the people who are making the purchases would prefer not to have to buy the product anyway.

Is it possible that people are simply more comfortable making donations in exchange for a product than they are simply giving money to a charity? Research by John Holmes and his colleagues (2002) has supported this idea, finding that people are more likely to help when they can pretend that they are acting in their own self-interest. In one study, Holmes and his team found that students were more likely to donate money to a needy charity when they were offered a small candle in return for their donation than when they were not offered the candle. However, and suggesting that they didn't really care about the candle that much, when the request was to contribute to a charity that did not seem that needy, contributions were smaller overall but were not greater when the candle was offered than when it was not. Again, it seems that people feel more comfortable being altruistic when they can pretend that they are really helping themselves—not violating the norm of self-interest.

INCREASING HELPING

Now that we have a fundamental understanding of the variables that influence the likelihood that we will help others, let's spend some time considering how we might use this information in our everyday life to try to become more helpful ourselves and to encourage those around us to do the same. In doing so we will make use of many of the principles of altruism that we have discussed in this chapter.

First, we need to remember that not all helping is based on other-concern—self-concern is important. People help in part because it makes them feel good, and therefore anything that we can do to increase the benefits of helping and to decrease the costs of helping would be useful. Consider, for instance, the research of Mark Snyder, who has extensively studied the people who volunteer to help other people who are suffering from AIDS (Snyder & Omoto, 2004; Snyder et al., 2004). To help understand which volunteers were most likely to continue to volunteer over time, Snyder and his colleagues (Omoto & Snyder, 1995) asked the AIDS volunteers to indicate why they volunteered. As you can see in **TABLE 24.2**, the researchers found that the people indicated that they volunteered for many different reasons, and these reasons fit well with our assumptions about human nature—they involve both self-concern and other-concern.

Omoto and Snyder (1995) found that the volunteers were more likely to continue their volunteer work if their reasons for volunteering involved self-related activities, such as understanding, personal development, or esteem enhancement. The volunteers who felt that they were getting something back from their work were likely to stay involved. In addition, Snyder and his colleagues found that people were more likely to continue volunteering when their existing social support networks were weak. This result suggests that some volunteers were using the volunteer opportunity to help them create better social connections (Omoto & Snyder, 1995). On the other hand, the volunteers who reported experiencing negative reactions about their helping from their friends and family members, which

TABLE 24.2. Reasons for Volunteering to Help AIDS Victims

Values
• Because of my humanitarian obligation to help others
• Because I enjoy helping other people
• Because I consider myself to be a loving and caring person
• Because people should do something about issues that are important to them
• Because of my personal values, convictions, and beliefs
Understanding
• To learn more about how to prevent AIDS
• To learn how to help people with AIDS
• To learn about how people cope with AIDS
• To understand AIDS and what it does to people
Personal Development
• To get to know people who are similar to myself
• To meet new people and make new friends
• To gain experience dealing with emotionally difficult topics
• To challenge myself and test my skills
• To learn about myself and my strengths and weaknesses
Community Concern
• Because of my sense of obligation to the gay community
• Because I consider myself an advocate for gay-related issues
• Because of my concern and worry about the gay community
• To get to know people in the gay community
• To help members of the gay community
Esteem Enhancement
• To make my life more stable
• To escape other pressures and stress in my life (e.g., from work, from home)
• To feel less lonely
• To feel needed

From Omoto and Snyder (1995).

made them feel embarrassed, uncomfortable, and stigmatized for helping, were also less likely to continue working as volunteers (Snyder et al., 1999).

These results again show that people will help more if they see it as rewarding. So if you want to get people to help, try to increase the rewards of doing so, for instance by enhancing their mood or by offering incentives. Simple things, such as noticing, praising, and even labeling helpful behavior can be enough. When children are told that they are "kind and helpful children," they contribute more of their prizes to other children (Grusec et al., 1978). Rewards work for adults too: People were more likely to donate to charity several weeks after they were described by another person as being "generous" and "charitable" people (Kraut, 1973). In short, once we start to think of ourselves as helpful people, self-perception takes over and we continue to help.

The nations and states that have passed Good Samaritan laws realize the importance of self-interest: If people must pay fines or face jail sentences if they don't help, then they are naturally more likely to help. And the programs in many schools, businesses, and other institutions that encourage students and workers to volunteer by rewarding them for doing so are also effective in increasing volunteering (Clary, Snyder, Ridge, et al., 1998; Clary, Snyder, & Stoukas, 1998).

Helping also occurs in part because of other-concern. We are more likely to help people we like and care about, feel similar to, and experience positive emotions with. Therefore, anything we can do to increase our connections with others will likely increase helping. We must work to encourage ourselves, our friends, and our children to interact with others—to help them meet and accept new people and to instill a sense of community and caring in them. These social connections will make us feel closer to others and increase the likelihood we will help them. We must also work to install the appropriate norms in our children. Kids must be taught not to be selfish and to value the norms of sharing and altruism.

One way to increase our connection with others is to make those people highly salient and personal. Charities and other organizations that seek to promote helping understand this and do the best they can to individualize the people they are asking us to help. When we see a single person suffering, we naturally feel strong emotional responses to that person. And, as we have seen, the emotions that we feel when others are in need are powerful determinants of helping. In fact, Paul Slovic (2007) found that people are simply unable to identify with statistical and abstract descriptions of need because they do not feel emotions for these victims in the same way they do for individuals. They argued that when people seem completely oblivious or numb to the needs of millions of people who are victims of genocide, hurricanes, and other atrocities, it is because the victims are presented as statistics rather than as individual cases. As Joseph Stalin, the Russian dictator who executed millions of Russians, put it, "A single death is a tragedy, a million deaths is a statistic."

We can also use what we have learned about helping in emergency situations to increase the likelihood of responding. Most importantly, we must remember how strongly pluralistic ignorance can influence the interpretation of events and how quickly responsibility can be diffused among the people present at an emergency. Therefore, in emergency situations we must attempt to counteract pluralistic ignorance and diffusion of responsibility by remembering that others do not necessarily know more than we do. Depend on your own interpretation—don't simply rely on your assumptions about what others are thinking and don't just assume that others will do the helping.

We must be sure to follow the steps in Latané and Darley's model, attempting to increase helping at each stage. We must make the emergency noticeable and clearly an emergency, for instance, by yelling out: "This is an emergency! Please call the police! I need help!" And we must attempt to avoid the diffusion of responsibility, for instance, by designating one individual to help: "You over there in the red shirt, please call 911 now!"

KEY TAKEAWAYS

- Some people—for instance, those with altruistic personalities—are more helpful than others.
- Gender differences in helping depend on the type of helping that is required. Men are more likely to help in situations that involve physical strength, whereas women are more likely to help in situations that involve long-term nurturance and caring, particularly within close relationships.
- Our perception of the amount of the need is important. We tend to provide less help to people who seem to have brought on their own problems or who don't seem to be working very hard to solve them on their own.
- In some cases, helping can create negative consequences. Dependency-oriented help may make the helped feel negative emotions, such as embarrassment and worry that they are seen as incompetent or dependent. Autonomy-oriented help is more easily accepted and will be more beneficial in the long run.
- Norms about helping vary across cultures, for instance, between Eastern and Western cultures.
- We can increase helping by using our theoretical knowledge about the factors that produce it. Our strategies can be based on using both self-concern and other-concern.

EXERCISES AND CRITICAL THINKING

1. Consider your own personality and compare it to that of some other people you know. Do you have an altruistic personality? Do you know people who seem to have one?
2. Imagine that you knew someone who was ill and needed help. How would you frame your help to make him or her willing to accept it?
3. Assume for a moment that you were in charge of creating an advertising campaign designed to increase people's altruism. On the basis of your reading, what approaches might you take?

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READING 25

Gender

Christia Spears Brown, Jennifer A. Jewell, and Michelle J. Tam

SOURCE

Brown, C. S., Jewell, J. A., & Tam, M. J. (2020). Gender. In R. Biswas-Diener & E. Diener (Eds.), *Noba textbook series: Psychology.* DEF Publishers. http://noba.to/ge5fdhba

LEARNING OBJECTIVES

- Distinguish gender and sex, as well as gender identity and sexual orientation.
- Discuss gender differences that exist, as well as those that do not actually exist.
- Understand and explain different theories of how gender roles are formed.
- Discuss sexism and its impact on gender.

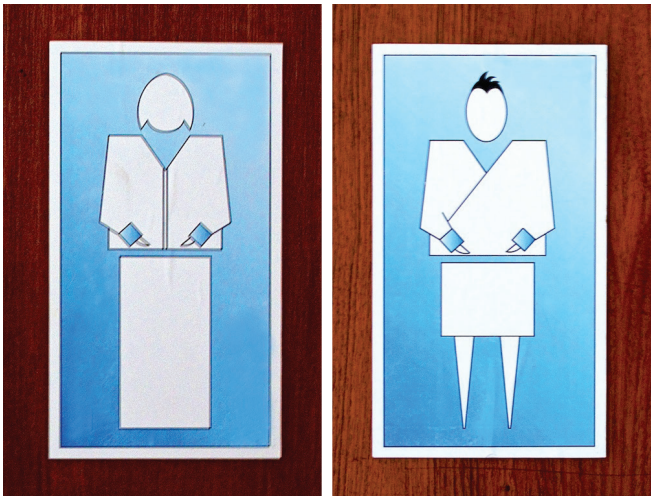
KEY TERMS

agender
ambivalent sexism
benevolent sexism
bigender
binary
cisgender
developmental intergroup theory
gender
gender constancy
gender discrimination
genderfluid
gender identity
gender nonbinary
genderqueer
gender roles
gender schema theory
gender stereotypes
hostile sexism
schemas
sex
sexual harassment
sexual orientation
social learning theory
transgender

This module discusses gender and its related concepts, including sex, gender roles, gender identity, sexual orientation, and sexism. In addition, this module includes a discussion of differences that exist between males and females and how these real gender differences compare to the stereotypes society holds about gender differences. In fact, there are significantly fewer real gender differences than one would expect relative to the large number of stereotypes about gender differences. This module then discusses theories of how gender roles develop and how they contribute to strong expectations for gender differences. Finally, the module concludes with a discussion of some of the consequences of relying on and expecting gender differences, such as gender discrimination, sexual harassment, and ambivalent sexism.

INTRODUCTION

Before we discuss gender in detail, it is important to understand what gender actually is. The terms *sex* and *gender* are frequently used interchangeably, though they have different meanings. In this context, **sex** refers to the biological category of male or female, as defined by physical differences in genetic composition and in reproductive anatomy and function. On the other hand, **gender** refers to the cultural, social, and psychological meanings that are associated with masculinity and femininity (Wood & Eagly, 2002). You can think of "male" and "female" as distinct categories of sex (a person is typically born a male or a female), but "masculine"



Gender refers to the cultural, social, and psychological meanings that are associated with masculinity and femininity. ["Uniquely Bhutanese" by Michael Foley/Flickr is licensed under CC BY-NC-ND 2.0.]

THE (TRANS)GENDER-BATHROOM DEBATE

In recent years, there has been much cultural and political debate over the right of transgender individuals to use the public bathroom of their choosing. This debate made major headlines in 2016 when North Carolina passed the Public Facilities Privacy & Security Act (commonly called House Bill 2 or HB2). This law required individuals to use the restroom that corresponded with their birth sex, meaning that transgender individuals could not use the bathroom that matched their gender identity. This law and the similar "bathroom bills" proposed by other states were met with widespread controversy, with opponents arguing that they were discriminatory and perpetuated inequality (Barnett et al., 2018). HB2 has since been repealed, but many states still do not protect the rights of transgender individuals to use their restrooms of choice. ■

and "feminine" as continuums associated with gender (everyone has a certain degree of masculine and feminine traits and qualities).

Beyond sex and gender, there are a number of related terms that are also often misunderstood. **Gender roles** are the behaviors, attitudes, and personality traits that are designated as either masculine or feminine in a given culture. It is common to think of gender roles in terms of **gender stereotypes**, or the beliefs and expectations people hold about the typical characteristics, preferences, and behaviors of men and women. A person's **gender identity** refers to their psychological sense of being male or female. In contrast, a person's **sexual orientation** is the direction of their emotional and erotic attraction toward members of the opposite sex, the same sex, or both sexes. These are important distinctions, and although we will not discuss each of these terms in detail, it is important to recognize that sex, gender, gender identity, and sexual orientation do not always correspond with one another. A person can be biologically male but have a female gender identity while being attracted to women, or any other combination of identities and orientations.

DEFINING GENDER

Historically, the terms *gender* and *sex* have been used interchangeably. Because of this, gender is often viewed as a **binary**—a person is either male *or* female—and it is assumed that a person's gender matches their biological sex. This is not always the case, however, and more recent research has separated these two terms. While the majority of people do identify with the gender that matches their biological sex (**cisgender**), an estimated 0.6% of the population identify with a gender that does not match their biological sex (**transgender**) (Flores et al., 2016). For example, an individual who is biologically male may identify as female, or vice versa.

In addition to separating gender and sex, recent research has also begun to conceptualize gender in ways beyond the gender binary. **Genderqueer** and **gender nonbinary** are umbrella terms used to describe a wide range of individuals who do not identify with and/or conform to the gender binary. These terms encompass a variety of more specific labels individuals may use to describe themselves. Some common labels are **genderfluid**, **agender**, and **bigender**. An individual who is genderfluid may identify as male, female, both, or neither at different times and in different circumstances. An individual who is agender may have no gender or describe themselves as having a neutral gender, while bigender individuals identify as two genders.

It is important to remember that sex and gender do not always match and that gender is not always binary; however, a large majority of prior research examining gender has not made these distinctions. Thus, the following sections will discuss gender as a binary.

GENDER DIFFERENCES

Differences between males and females can be based on (a) actual gender differences (i.e., men and women are actually different in some abilities), (b) gender roles (i.e., differences in how men and women are supposed to act), or (c) gender stereotypes (i.e., differences in how we *think* men and women are). Sometimes gender stereotypes and gender roles reflect actual gender differences, but sometimes they do not.

What are actual gender differences? In terms of language and language skills, girls develop language skills earlier and know more words than boys; this does not, however, translate into long-term differences. Girls are also more likely than boys to offer praise, to agree with the person they're talking to, and to elaborate on the other person's comments; boys, in contrast, are more likely than girls to assert their opinion

Boys exhibit higher rates of unprovoked physical aggression than girls and are more likely to play organized rough-and-tumble games. ["gender stereotyping" by Aislinn Ritchie/Flickr is licensed under CC BY-SA 2.0.]

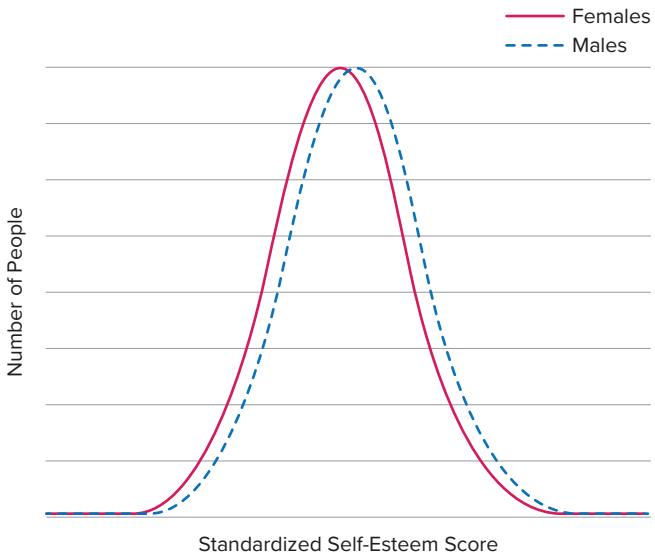


FIGURE 25.1. Although our gender stereotypes paint males and females as drastically different from each other, even when a difference exists there is considerable overlap in the presence of that trait between genders. This graph shows the average difference in self-esteem between boys and girls. Boys have a higher average self-esteem than girls, but the average scores are much more similar than different. ["Gender and Self-Esteem" by Judy Schmitt is licensed under CC BY-NC-SA 4.0. Adapted from Hyde (2005).]

and offer criticisms (Leaper & Smith, 2004). In terms of temperament, boys are slightly less able to suppress inappropriate responses and slightly more likely to blurt things out than girls (Else-Quest et al., 2006).

With respect to aggression, boys exhibit higher rates of unprovoked physical aggression than girls, but no difference in provoked aggression (Hyde, 2005). Some of the biggest differences involve the play styles of children. Boys frequently play organized rough-and-tumble games in large groups, while girls often play less physical activities in much smaller groups (Maccoby, 1998). There are also differences in the rates of depression, with girls much more likely than boys to be depressed after puberty. After puberty, girls are also more likely to be unhappy with their bodies than boys.

However, there is considerable variability between individual males and individual females. Also, even when there are mean level differences, the actual size of most of these differences is quite small. This means knowing someone's gender does not help much in predicting his or her actual traits. For example, in terms of activity level, boys are considered more active than girls. However, 42% of girls are more active than the average boy (but so are 50% of boys; see **FIGURE 25.1** for a depiction of this phenomenon in a comparison of male and female self-esteem). Furthermore, many gender differences do not reflect innate differences, but instead reflect differences in specific experiences and socialization. For example, one presumed gender difference is that boys show better spatial abilities than girls. However, Tzuriel and Egozi (2010) gave girls the chance to practice their spatial skills (by imagining a line drawing was different shapes) and discovered that, with practice, this gender difference completely disappeared.

Many domains we assume differ across genders are really based on gender stereotypes and not actual differences. Based on large meta-analyses, the analyses of thousands of studies across more than one million people, research has shown: Girls are not more fearful, shy, or scared of new things than boys; boys are not more angry than girls; girls are not more emotional than boys; boys do not perform better at math than girls; and girls are not more talkative than boys (Hyde, 2005).

In the following sections, we'll investigate gender roles, the part they play in creating these stereotypes, and how they can affect the development of real gender differences.

GENDER ROLES

As mentioned earlier, gender roles are well-established social constructions that may change from culture to culture and over time. In American culture, we commonly think of gender roles in terms of gender stereotypes, or the beliefs and expectations people hold about the typical characteristics, preferences, and behaviors of men and women.

By the time we are adults, our gender roles are a stable part of our personalities, and we usually hold many gender stereotypes. When do children start to learn about gender? Very early (see **FIGURE 25.2**). By their first birthday, children can distinguish faces by gender. By their second birthday, they can label others' gender and even sort objects into gender-typed categories. By the third birthday, children can consistently identify their own gender (see Martin et al., 2002, for a review). At this age, children believe sex is determined by external attributes, not biological attributes. Between 3 and 6 years of age, children learn that gender is constant and can't

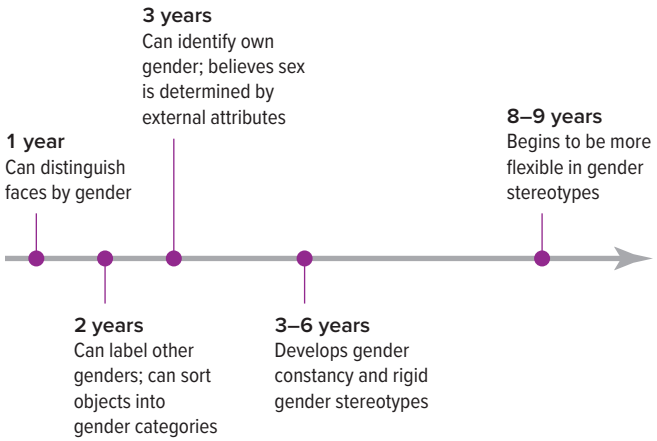


FIGURE 25.2. Children develop the ability to classify gender very early in life. [This work, "Gender Classification Timeline," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Figure 2" by Christia Spears Brown, Jennifer A. Jewell, and Michelle J. Tam/Noba, which is licensed under CC BY-NC-SA 4.0.]

change simply by changing external attributes, having developed **gender constancy**. During this period, children also develop strong and rigid gender stereotypes. Stereotypes can refer to play (e.g., boys play with trucks, and girls play with dolls), traits (e.g., boys are strong, and girls like to cry), and occupations (e.g., men are doctors and women are nurses). These stereotypes stay rigid until children reach about age 8 or 9. Then they develop cognitive abilities that allow them to be more flexible in their thinking about others.

How do our gender roles and gender stereotypes develop and become so strong? Many of our gender stereotypes are so strong because we emphasize gender so much in culture (Bigler & Liben, 2007). For example, males and females are treated differently before they are even born. When someone learns of a new pregnancy, the first question asked is "Is it a boy or a girl?" Immediately upon hearing the answer, judgments are made about the child: Boys will be rough and like blue, while girls will be delicate and like pink. **Developmental intergroup theory** postulates that adults' heavy focus on gender leads children to pay attention to gender as a key source of information about themselves and others, to seek out any possible gender differences, and to form rigid stereotypes based on gender that are subsequently difficult to change.

There are also psychological theories that partially explain how children form their own gender roles after they learn to differentiate based on gender. The first of these theories is **gender schema theory**. Gender schema theory argues that children are active learners who essentially socialize themselves. In this case, children actively organize others' behavior, activities, and attributes into gender categories, which are known as **schemas**. These schemas then affect what children notice and remember later. People of all ages are more likely to remember schema-consistent behaviors and attributes than schema-inconsistent behaviors and attributes. So, people are more likely to remember men, and forget women, who are firefighters. They also misremember schema-inconsistent information. If research participants are shown pictures of someone standing at the stove, they are more likely to remember the person to be cooking if depicted as a woman, and the person to be repairing the stove if depicted as a man. By only remembering schema-consistent information, gender schemas strengthen more and more over time.

People are more likely to remember schema-consistent behaviors and attributes than schema-inconsistent behaviors and attributes. For example, people are more likely to remember men, and forget women, who are firefighters. ["The girls" by Billy V/Flickr is licensed under CC BY-NC-SA 2.0.]

A second theory that attempts to explain the formation of gender roles in children is **social learning theory**. Social learning theory argues that gender roles are learned through reinforcement, punishment, and modeling. Children are rewarded and reinforced for behaving in concordance with gender roles and punished for breaking gender roles. In addition, social learning theory argues that children learn many of their gender roles by modeling the behavior of adults and older children and, in doing so, develop ideas about what behaviors are appropriate for each gender. Social learning theory has less support than gender schema theory—research shows that parents do reinforce gender-appropriate play but for the most part treat their male and female children similarly (Lytton & Romney, 1991).

GENDER SEXISM AND SOCIALIZATION

Treating boys and girls, and men and women, differently is both a *consequence* of gender differences and a *cause* of gender differences. Differential treatment on the basis of gender is also referred to as **gender discrimination** and is an inevitable consequence of gender stereotypes. When it is based on unwanted treatment related to sexual behaviors or appearance, it is called **sexual harassment**. By the time boys and girls reach the end of high school, most have experienced some form of sexual harassment, most commonly in the form of unwanted touching or comments, being the target of jokes, having their body parts rated, or being called names related to sexual orientation.

Different treatment by gender begins with parents. A meta-analysis of research from the United States and Canada found that parents most frequently treated sons and daughters differently by encouraging gender-stereotypical activities (Lytton & Romney, 1991). Fathers, more than mothers, are particularly likely to encourage gender-stereotypical play, especially in sons. Parents also talk to their children differently based on stereotypes. For example, parents talk about numbers and counting twice as often with sons than daughters (Chang et al., 2011) and talk to sons in more detail about science than with daughters. Parents are also much more likely to discuss emotions with their daughters than their sons.

Children do a large degree of socializing themselves. By age 3, children play in gender-segregated play groups and expect a high degree of conformity. Children who are perceived as gender atypical (i.e., do not conform to gender stereotypes) are more likely to be bullied and rejected than their more gender-conforming peers.

Gender stereotypes typically maintain gender inequalities in society. The concept of **ambivalent sexism** recognizes the complex nature of gender attitudes, in which women are often associated with positive and negative qualities (Glick & Fiske, 2001). It has two components. First, **hostile sexism** refers to the negative attitudes of women as inferior and incompetent relative to men. Second, **benevolent sexism** refers to the perception that women need to be protected, supported, and adored by men. There has been considerable empirical support for benevolent sexism, possibly because it is seen as more socially acceptable than hostile sexism. Gender stereotypes are found not just in American culture. Across cultures, males tend to be associated with stronger and more active characteristics than females (Best, 2001).

In recent years, gender and related concepts have become a common focus of social change and social debate. Many societies, including American society, have seen a rapid change in perceptions of gender roles, media portrayals of gender, and legal trends relating to gender. For example, there has been an increase in children's toys attempting to cater to both genders (such as Legos marketed to girls), rather than catering to traditional stereotypes. Nationwide, the drastic surge in acceptance of homosexuality and gender questioning has resulted in a rapid push for legal change to keep up with social change. Laws such as "Don't Ask, Don't Tell" and the Defense of Marriage Act (DOMA), both of which were enacted in the 1990s, have met severe resistance on the grounds of being discriminatory toward sexual minority groups and have been accused of unconstitutionality less than 20 years after their implementation. Change in perceptions of gender is also evident in social issues such as sexual harassment, a term that only entered the mainstream mindset in the 1991 Clarence Thomas/Anita Hill scandal. As society's gender roles and gender restrictions continue to fluctuate, the legal system and the structure of American society will continue to change and adjust.

Important Gender-Related Events in the United States

- 1920: *19th Amendment* (women's suffrage ratified)
- 1941–1945: World War II forces millions of women to enter the workforce
- 1948: Universal Declaration of Human Rights
- 1963: Congress passes *Equal Pay Act*
- 1964: Congress passes *Civil Rights Act*, which outlaws sex discrimination
- 1969: Stonewall riots in New York City, forcing gay rights into the American spotlight
- 1972: Congress passes *Equal Rights Amendment*; *Title IX* prohibits sex discrimination in schools and sports
- 1973: American Psychiatric Association removes homosexuality from the *DSM*
- 1981: First woman appointed to the U.S. Supreme Court
- 1987: Average woman earned $0.68 for every $1.00 earned by a man
- 1992: World Health Organization no longer considers homosexuality an illness
- 1993: Supreme Court rules that sexual harassment in the workplace is illegal
- 2011: *Don't Ask, Don't Tell* is repealed, allowing people who identify as gay to serve openly in the U.S. military
- 2012: President Barack Obama becomes the first American president to openly support LGBT rights and marriage equality
- 2013: Ban against women serving in military combat positions is lifted

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READING 26

Prejudice and Discrimination

SOURCE

OpenStax. (2019). *Psychology.* OpenStax CNX. https://openstax.org/details/books/psychology

LEARNING OBJECTIVES

- Define and distinguish among prejudice, stereotypes, and discrimination.
- Provide examples of prejudice, stereotypes, and discrimination.
- Explain why prejudice and discrimination exist.

KEY TERMS

ageism
confirmation bias
discrimination
homophobia
in-group
in-group bias
out-group
prejudice
racism
self-fulfilling prophecy
sexism
stereotype

Human conflict can result in crime, war, and mass murder, such as genocide. Prejudice and discrimination often are root causes of human conflict, which explains how strangers come to hate one another to the extreme of causing others harm. Prejudice and discrimination affect everyone. In this section we will examine the definitions of prejudice and discrimination, examples of these concepts, and causes of these biases.

UNDERSTANDING PREJUDICE AND DISCRIMINATION

Humans are very diverse, and although we share many similarities, we also have many differences. The social groups we belong to help form our identities (Tajfel, 1974). These differences may be difficult for some people to reconcile, which may lead to prejudice toward people who are different. **Prejudice** is a negative attitude and feeling toward an individual based solely on one's membership in a particular social group (Allport, 1954; Brown, 2010). Prejudice is common against people who are members of an unfamiliar cultural group. Thus, certain types of education, contact, interactions, and building relationships with members of different cultural groups can reduce the tendency toward prejudice. In fact, simply imagining interacting with members of different cultural groups might affect prejudice. Indeed, when experimental participants were asked to imagine themselves positively interacting with someone from a different group, this led to an increased positive attitude toward the other group and an increase in positive traits associated with the other group. Furthermore, imagined social interaction can reduce

(a) (b) (c)

Prejudice and discrimination occur across the globe. (a) A 1939 sign in German-occupied Poland warns "No Entrance for Poles!" (b) An African American male drinks from a designated "colored" water fountain in Oklahoma in 1939 during the era of racial segregation as a practice of discrimination. (c) Members of the Westboro Baptist Church, widely identified as a hate group, engage in discrimination based on religion and sexual orientation. [(a) "No entrance for poles1"/Wikimedia Commons is in the public domain; (b) "Negro drinking at 'Colored' water cooler in streetcar terminal, Oklahoma City, Oklahoma" by Russell Lee/U.S. Farm Security Administration/Wikimedia Commons is in the public domain; (c) "Westboro BC 03022010 RichmondVa" by JCWilmore/Wikimedia Commons is licensed under CC BY 3.0.]

TABLE 26.1. Connecting Stereotypes, Prejudice, and Discrimination

Item	Function	Connection	Example
Stereotype	Cognitive; thoughts about people	Overgeneralized beliefs about people may lead to prejudice.	"Yankees fans are arrogant and obnoxious."
Prejudice	Affective; feelings about people, both positive and negative	Feelings may influence treatment of others, leading to discrimination.	"I hate Yankees fans; they make me angry."
Discrimination	Behavioral; positive or negative treatment of others	Holding stereotypes and harboring prejudice may lead to excluding, avoiding, and biased treatment of group members.	"I would never hire or become friends with a person if I knew he or she were a Yankees fan."

anxiety associated with inter-group interactions (Crisp & Turner, 2009).

What are some examples of social groups that you belong to that contribute to your identity? Social groups can include gender, race, ethnicity, nationality, social class, religion, sexual orientation, profession, and many more. And, as is true for social roles, you can simultaneously be a member of more than one social group. An example of prejudice is having a negative attitude toward people who are not born in the United States. Although people holding this prejudiced attitude do not know all people who were not born in the United States, they dislike them due to their status as foreigners.

Can you think of a prejudiced attitude you have held toward a group of people? How did your prejudice develop? Prejudice often begins in the form of a **stereotype**—that is, a specific belief or assumption about individuals based solely on their membership in a group, regardless of their individual characteristics. Stereotypes become overgeneralized and applied to all members of a group. For example, someone holding prejudiced attitudes toward older adults may believe that older adults are slow and incompetent (Cuddy et al., 2005; Nelson, 2004). We cannot possibly know each individual person of advanced age to know that all older adults are slow and incompetent. Therefore, this negative belief is overgeneralized to all members of the group, even though many of the individual group members may in fact be spry and intelligent.

Another example of a well-known stereotype involves beliefs about racial differences among athletes. As Hodge et al. (2008) point out, Black male athletes are often believed to be more athletic, yet less intelligent, than their White male counterparts. These beliefs persist despite a number of high-profile examples to the contrary. Sadly, such beliefs often influence how these athletes are treated by others and how they view themselves and their own capabilities. Whether or not you agree with a stereotype, stereotypes are generally well-known within a given culture (Devine, 1989).

Sometimes people will act on their prejudiced attitudes toward a group of people, and this behavior is known as discrimination. **Discrimination** is negative action toward an individual as a result of the individual's membership in a particular group (Allport, 1954; Dovidio & Gaertner, 2004). As a result of holding negative beliefs (stereotypes) and negative attitudes (prejudice) about a particular group, people often treat the target of prejudice poorly, such as excluding older adults from their circle of friends. **TABLE 26.1** summarizes the characteristics of stereotypes, prejudice, and discrimination. Have you ever been the target of discrimination? If so, how did this negative treatment make you feel?

So far, we've discussed stereotypes, prejudice, and discrimination as negative thoughts, feelings, and behaviors because these are typically the most problematic. However, it is important to also point out that people can hold positive thoughts, feelings, and behaviors toward individuals based on group membership; for example, they would show preferential treatment for people who are like themselves—that is, who share the same gender, race, or favorite sports team.

LINK TO LEARNING

This video demonstrates the concepts of prejudice, stereotypes, and discrimination. In the video, a social experiment is conducted in a park where three people try to steal a bike out in the open. The race and gender of the thief is varied: a White male teenager, a Black male teenager, and a White female. Does anyone try to stop them? The treatment of the teenagers in the video demonstrates the concept of racism.

TYPES OF PREJUDICE AND DISCRIMINATION

When we meet strangers we automatically process three pieces of information about them: race, gender, and age (Ito & Urland, 2003). Why are these aspects of an unfamiliar person so important? Why don't we instead notice whether their eyes are friendly, whether they are smiling, their height, the type of clothes they are wearing? Although these secondary characteristics are important in forming a first impression of a stranger, the social categories of race, gender, and age provide a wealth of information about an individual. This information, however, often is based on stereotypes. We may have

different expectations of strangers depending on their race, gender, and age. What stereotypes and prejudices do you hold about people who are from a race, gender, and age group different from your own?

Racism

Racism is prejudice and discrimination against an individual based solely on the individual's membership in a specific racial group (such as toward African Americans, Asian Americans, Latinos, Native Americans, European Americans). What are some stereotypes of various racial or ethnic groups? Research suggests cultural stereotypes for Asian Americans include cold, sly, and intelligent; for Latinos, cold and unintelligent; for European Americans, cold and intelligent; and for African Americans, aggressive, athletic, and more likely to be law breakers (Devine & Elliot, 1995; Dixon & Linz, 2000; Fiske et al., 2002; Sommers & Ellsworth, 2000).

Racism exists for many racial and ethnic groups. For example, Blacks are significantly more likely to have their vehicles searched during traffic stops than Whites, particularly when Blacks are driving in predominately White neighborhoods, a phenomenon often termed "DWB," or "driving while Black" (Rojek et al., 2012). Mexican Americans and other Latino groups also are targets of racism from the police and other members of the community. For example, when purchasing items with a personal check, Latino shoppers are more likely than White shoppers to be asked to show formal identification (Dovidio et al., 2010).

In one case of alleged harassment by the police, several East Haven, Connecticut, police officers were arrested on federal charges due to reportedly continued harassment and brutalization of Latinos. When the accusations came out, the mayor of East Haven was asked, "What are you doing for the Latino community today?" The Mayor responded, "I might have tacos when I go home, I'm not quite sure yet" (Latino Rebels, 2012). This statement undermines the important issue of racial profiling and police harassment of Latinos, while belittling Latino culture by emphasizing an interest in a food product stereotypically associated with Latinos.

Racism is prevalent toward many other groups in the United States, including Native Americans, Arab Americans, Jewish Americans, and Asian Americans. Have you witnessed racism toward any of these racial or ethnic groups? Are you aware of racism in your community?

One reason modern forms of racism, and prejudice in general, are hard to detect is related to the dual attitudes model (Wilson et al., 2000). Humans have two forms of attitudes: explicit attitudes, which are conscious and controllable, and implicit attitudes, which are unconscious and uncontrollable (Devine, 1989; Olson & Fazio, 2003). Because holding egalitarian views is socially desirable (Plant & Devine, 1998), most people do not show extreme racial bias or other prejudices on measures of their explicit attitudes. However, measures of implicit attitudes often show evidence of mild to strong racial bias or other prejudices (Greenwald et al., 1998; Olson & Fazio, 2003).

Sexism

Sexism is prejudice and discrimination toward individuals based on their sex. Typically, sexism takes the form of men holding biases against women, but either sex can show sexism toward their own or their opposite sex. Like racism, sexism may be subtle and difficult to detect. Common forms of sexism in modern society include gender role expectations, such as expecting women to be the caretakers of the household. Sexism also includes people's expectations for how members of a gender group should behave. For example, women are expected to be friendly, passive, and nurturing, and when women behave in an unfriendly, assertive, or neglectful manner they often are disliked for violating their gender role (Rudman, 1998). Research by Laurie Rudman (1998) finds that when female job applicants self-promote, they are likely to be viewed as competent, but they may be disliked and are less likely to be hired because they violated gender expectations for modesty. Sexism can exist on a societal level such as in hiring, employment opportunities, and education. Women are less likely to be hired or promoted in male-dominated professions such as engineering, aviation, and construction (**FIGURE 26.1**) (Blau et al., 2010; Ceci & Williams, 2011). Have you ever experienced or witnessed sexism? Think about your family members' jobs or careers. Why do you think there are differences in the jobs women and men have, such as more women nurses but more male surgeons (Betz, 2008)?

FIGURE 26.1. Women now have many jobs that were previously closed to them, although they still face challenges in male-dominated occupations. ["Female IDF Soldier Shooting Practice" by Alex/Flickr is licensed under CC BY 2.0.]

Ageism

People often form judgments and hold expectations about people based on their age. These judgments and expectations can lead to **ageism**, or prejudice and discrimination toward individuals based solely on their age. Typically, ageism occurs against older adults, but ageism also can occur toward younger adults. Think of expectations you hold for older adults. How could someone's expectations influence the feelings they hold toward individuals from older age groups? Ageism is widespread in U.S. culture (Nosek, 2005), and a common ageist attitude toward older adults is that they are incompetent, physically weak, and slow (Greenberg et al., 2002), and some people consider older adults less attractive. Some cultures, however, including some Asian, Latino, and African American cultures, both outside and within the United States, afford older adults respect and honor.

Ageism can also occur toward younger adults. What expectations do you hold toward younger people? Does society expect younger adults to be immature and irresponsible? How might these two forms of ageism affect a younger and older adult who are applying for a sales clerk position?

Homophobia

Another form of prejudice is **homophobia**: prejudice and discrimination of individuals based solely on their sexual orientation. Like ageism, homophobia is a widespread prejudice in U.S. society that is tolerated by many people (Herek & McLemore, 2013; Nosek, 2005). Negative feelings often result in discrimination, such as the exclusion of lesbian, gay, bisexual, and transgender (LGBT) people from social groups and the avoidance of LGBT neighbors and co-workers. This discrimination also extends to employers deliberately declining to hire qualified LGBT job applicants. Have you experienced or witnessed homophobia? If so, what stereotypes, prejudiced attitudes, and discrimination were evident?

WHY DO PREJUDICE AND DISCRIMINATION EXIST?

Prejudice and discrimination persist in society due to social learning and conformity to social norms. Children learn prejudiced attitudes and beliefs from society: their parents, teachers, friends, the media, and other sources of socialization, such as Facebook (O'Keeffe & Clarke-Pearson, 2011). If certain types of prejudice and discrimination are acceptable in a society, there may be normative pressures to conform and share those prejudiced beliefs, attitudes, and behaviors. For example, public and private schools are still somewhat segregated by social class. Historically, only children from wealthy families could afford to attend private schools, whereas children from middle- and low-income families typically attended public schools. If a child from a low-income family received a merit scholarship to attend a private school, how might the child be treated by classmates? Can you recall a time when you held prejudiced attitudes or beliefs or acted in a discriminatory manner because your group of friends expected you to?

DIG DEEPER

Research into Homophobia

Some people are quite passionate in their hatred for nonheterosexuals in our society. In some cases, people have been tortured and/or murdered simply because they were not heterosexual. This passionate response has led some researchers to question what motives might exist for homophobic people. Adams et al. (1996) conducted a study investigating this issue, and their results were quite an eye-opener.

In this experiment, male college students were given a scale that assessed how homophobic they were; those with extreme scores were recruited to participate in the experiment. In the end, 64 men agreed to participate and were split into 2 groups: homophobic men and nonhomophobic men. Both groups of men were fitted with a penile plethysmograph, an instrument that measures changes in blood flow to the penis and serves as an objective measurement of sexual arousal.

All men were shown segments of sexually explicit videos. One of these videos involved a sexual interaction between a man and a woman (heterosexual clip). One video displayed two females engaged in a sexual interaction (homosexual female clip), and the final video displayed two men engaged in a sexual interaction (homosexual male clip). Changes in penile tumescence were recorded during all three clips, and a subjective measurement of sexual arousal was also obtained. While both groups of men became sexually aroused to the heterosexual and female homosexual video clips, only those men who were identified as homophobic showed sexual arousal to the homosexual male video clip. While all men reported that their erections indicated arousal for the heterosexual and female homosexual clips, the homophobic men indicated that they were not sexually aroused (despite their erections) to the male homosexual clips. Adams et al. (1996) suggest that these findings may indicate that homophobia is related to homosexual arousal that the homophobic individuals either deny or are unaware of. ■

STEREOTYPES AND SELF-FULFILLING PROPHECY

When we hold a stereotype about a person, we have expectations that he or she will fulfill that stereotype. A **self-fulfilling prophecy** is an expectation held by a person that alters his or her behavior in a way that tends to make it true. When we hold stereotypes about a person, we tend to treat the person according to our expectations. This treatment can influence the person to act according to our stereotypic expectations, thus confirming our stereotypic beliefs. Research by Rosenthal and Jacobson (1968) found that disadvantaged students whose teachers expected them to perform well had higher grades than disadvantaged students whose teachers expected them to do poorly.

Consider this example of cause and effect in a self-fulfilling prophecy: If an employer expects an openly gay male job applicant to be incompetent, the potential employer might treat the applicant negatively during the interview by engaging in less conversation, making little eye contact, and generally behaving coldly toward the applicant (Hebl et al., 2002). In turn, the job applicant will perceive that the potential employer dislikes him, and he will respond by giving shorter responses to interview questions, making less eye contact, and generally disengaging from the interview. After the interview, the employer will reflect on the applicant's behavior, which seemed cold and distant, and the employer will conclude, based on the applicant's poor performance during the interview, that the applicant was in fact incompetent. Thus, the employer's stereotype—gay men are incompetent and do not make good employees—is reinforced. Do you think this job applicant is likely to be hired? Treating individuals according to stereotypic beliefs can lead to prejudice and discrimination.

Another dynamic that can reinforce stereotypes is confirmation bias. When interacting with the target of our prejudice, we tend to pay attention to information that is consistent with our stereotypic expectations and ignore information that is inconsistent with our expectations. In this process, known as **confirmation bias**, we seek out information that supports our stereotypes and ignore information that is inconsistent with our stereotypes (Wason & Johnson-Laird, 1972). In the job interview example, the employer may not have noticed that the job applicant was friendly and engaging, and that he provided competent responses to the interview questions in the beginning of the interview. Instead, the employer focused on the job applicant's performance in the later part of the interview, after the applicant changed his demeanor and behavior to match the interviewer's negative treatment.

Have you ever fallen prey to the self-fulfilling prophecy or confirmation bias, either as the source or target of such bias? How might we stop the cycle of the self-fulfilling prophecy? Social class stereotypes of individuals tend to arise when information about the individual is ambiguous. If information is unambiguous, stereotypes do not tend to arise (Baron et al., 1995).

IN-GROUPS AND OUT-GROUPS

As discussed previously in this section, we all belong to a gender, race, age, and socioeconomic group. These groups provide a powerful source of our identity and self-esteem (Tajfel & Turner, 1979). These groups serve as our in-groups. An **in-group** is a group that we identify with or see ourselves as belonging to. A group that we don't belong to, or an **out-group**, is a group that we view as fundamentally different from us. For example, if you are female, your gender in-group includes all females, and your gender out-group includes all males (FIGURE 26.2). People often view gender groups as being fundamentally different from each other in personality traits, characteristics, social roles, and interests. Because we often feel a strong sense of belonging and emotional connection to our in-groups, we develop **in-group bias**: a preference for our own group over other groups. This in-group bias can result in prejudice and discrimination because the out-group is perceived as different and is less preferred than our in-group.

Despite the group dynamics that seem only to push groups toward conflict, there are forces that promote reconciliation between groups: the expression of empathy, the acknowledgment of past suffering on both sides, and the halt of destructive behaviors.

FIGURE 26.2. These children are very young, but they are already aware of their gender in-group and out-group. ["Celio Azzurro" by Simone Ramella/Flickr is licensed under CC BY 2.0.]

One function of prejudice is to help us feel good about ourselves and maintain a positive self-concept. This need to feel good about ourselves extends to our in-groups: We want to feel good and protect our in-groups. We seek to resolve threats individually and at the in-group level. This often happens by blaming an out-group for the problem. Scapegoating is the act of blaming an out-group when the in-group experiences frustration or is blocked from obtaining a goal (Allport, 1954).

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READING 27

Cognitive Development in Childhood

Robert Siegler

SOURCE

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LEARNING OBJECTIVES

- Identify and describe the main areas of cognitive development.
- Describe major theories of cognitive development and what distinguishes them.
- Understand how nature and nurture work together to produce cognitive development.
- Understand why cognitive development is sometimes viewed as discontinuous and sometimes as continuous.
- Know some ways in which research on cognitive development is being used to improve education.

KEY TERMS

Chutes and Ladders
concrete operational reasoning stage
conservation problems
continuous development
depth perception
discontinuous development
formal operational reasoning stage
information processing theories
nature
numerical magnitudes
nurture
object permanence task
phonemic awareness
Piaget's stage theory
preoperational reasoning stage
qualitative changes
quantitative changes
sensorimotor stage
sociocultural theories

This module examines what cognitive development is, major theories about how it occurs, the roles of nature and nurture, whether it is continuous or discontinuous, and how research in the area is being used to improve education.

INTRODUCTION

By the time you reach adulthood, you have learned a few things about how the world works. You know, for instance, that you can't walk through walls or leap into the tops of trees. You know that although you cannot see your car keys they've got to be around here someplace. What's more, you know that if you want to communicate complex ideas like ordering a triple-shot soy vanilla latte with chocolate sprinkles it's better to use words with meanings attached to them rather than simply gesturing and grunting. People accumulate all this useful knowledge through the process of cognitive development, which involves a multitude of factors, both inherent and learned.

Cognitive development refers to the development of thinking across the lifespan. Defining thinking can be problematic, because no clear boundaries separate thinking from other mental activities. Thinking obviously involves the higher mental processes: problem solving, reasoning, creating, conceptualizing, categorizing, remembering, planning, and so on. However, thinking also involves other mental processes that seem more basic and at which even toddlers are skilled—such as perceiving objects and events in the environment, acting skillfully on objects to obtain goals, and understanding and producing language. Yet other areas of human development that involve thinking are not usually associated with cognitive

Cognitive development in childhood is about change. From birth to adolescence, a young person's mind changes dramatically in many important ways. ["Ulaanbaatar, Mongolia" by Carla Gomez Monroy/ One Laptop per Child/Flickr is licensed under CC BY 2.0.]

development, because thinking isn't a prominent feature of them—such as personality and temperament.

As the name suggests, cognitive development is about change. Children's thinking changes in dramatic and surprising ways. Consider DeVries's (1969) study of whether young children understand the difference between appearance and reality. To find out, she brought an unusually even-tempered cat named Maynard to a psychology laboratory and allowed the 3- to 6-year-old participants in the study to pet and play with him. DeVries then put a mask of a fierce dog on Maynard's head, and asked the children what Maynard was. Despite all of the children having identified Maynard previously as a cat, now most 3-year-olds said that he was a dog and claimed that he had a dog's bones and a dog's stomach. In contrast, the 6-year-olds weren't fooled; they had no doubt that Maynard remained a cat. Understanding how children's thinking changes so dramatically in just a few years is one of the fascinating challenges in studying cognitive development.

There are several main types of theories of child development. Stage theories, such as **Piaget's stage theory**, focus on whether children progress through qualitatively different stages of development. **Sociocultural theories**, such as that of Lev Vygotsky, emphasize how other people and the attitudes, values, and beliefs of the surrounding culture, influence children's development. **Information processing theories**, such as that of David Klahr, examine the mental processes that produce thinking at any one time and the transition processes that lead to growth in that thinking.

At the heart of all of these theories, and indeed of all research on cognitive development, are two main questions: (1) How do nature and nurture interact to produce cognitive development? (2) Does cognitive development progress through qualitatively distinct stages? In the remainder of this module, we examine the answers that are emerging regarding these questions, as well as ways in which cognitive developmental research is being used to improve education.

NATURE AND NURTURE

The most basic question about child development is how nature and nurture together shape development. **Nature** refers to our biological endowment, the genes we receive from our parents. **Nurture** refers to the environments, social as well as physical, that influence our development, everything from the womb in which we develop before birth to the homes in which we grow up, the schools we attend, and the many people with whom we interact.

The nature-nurture issue is often presented as an either-or question: Is our intelligence (for example) due to our genes or to the environments in which we live? In fact, however, every aspect of development is produced by the interaction of genes and environment. At the most basic level, without genes, there would be no child, and without an environment to provide nurture, there also would be no child.

The way in which nature and nurture work together can be seen in findings on visual development. Many people view vision as something that people either are born with or that is purely a matter of biological maturation, but it also depends on the right kind of experience at the right time. For example, development of **depth perception**, the ability to actively perceive the distance from oneself to objects in the environment, depends on seeing patterned light and having normal brain activity in response to the patterned light, in infancy (Held, 1993). If no patterned light is received, for example when a baby has severe cataracts or blindness that is not surgically corrected until later in development, depth perception remains abnormal even after the surgery.

Adding to the complexity of the nature-nurture interaction, children's genes lead to their eliciting different treatment from other people, which influences their cognitive development. For example, infants' physical attractiveness and temperament are influenced considerably by their genetic inheritance, but it is also the case that parents provide more sensitive and affectionate care to easygoing and attractive infants than to difficult and less attractive ones, which can contribute to the infants' later cognitive development (Langlois et al., 1995; van den Boom & Hoeksma, 1994).

Also contributing to the complex interplay of nature and nurture is the role of children in shaping their own cognitive development. From the first days out of the womb, children actively choose to attend more to some things and less to others. For example, even 1-month-olds choose to look at their mother's face more than at the faces of other women of the same age and general level of attractiveness (Bartrip et al., 2001). Children's contributions to their own

A child that is perceived to be attractive and calm may receive a different sort of care and attention from adults and as a result enjoy a developmental advantage. ["Pink Piggie Plucked from his Bath" by Patrick Henry/Flickr is licensed under CC BY-NC-SA 2.0.]

cognitive development grow larger as they grow older (Scarr & McCartney, 1983). When children are young, their parents largely determine their experiences: whether they will attend day care, the children with whom they will have play dates, the books to which they have access, and so on. In contrast, older children and adolescents choose their environments to a larger degree. Their parents' preferences largely determine how 5-year-olds spend time, but 15-year-olds' own preferences largely determine when, if ever, they set foot in a library. Children's choices often have large consequences. To cite one example, the more children choose to read, the more their reading improves in future years (Baker et al., 2000). Thus, the issue is not whether cognitive development is a product of nature or nurture; rather, the issue is how nature and nurture work together to produce cognitive development.

DOES COGNITIVE DEVELOPMENT PROGRESS THROUGH DISTINCT STAGES?

Some aspects of the development of living organisms, such as the growth of the width of a maple tree, involve **quantitative changes**, with the tree getting a little wider each year. Other changes, such as the life cycle of a ladybug, involve **qualitative changes**, with the creature becoming a totally different type of entity after a transition than before (FIGURE 27.1). The existence of both gradual, quantitative changes and relatively sudden, qualitative changes in the world has led researchers who study cognitive development to ask whether changes in children's thinking are gradual and **continuous** or sudden and **discontinuous.**

The great Swiss psychologist Jean Piaget proposed that children's thinking progresses through a series of four discrete stages. By "stages," he meant periods during which children reasoned similarly about many superficially different problems, with the stages occurring in a fixed order and

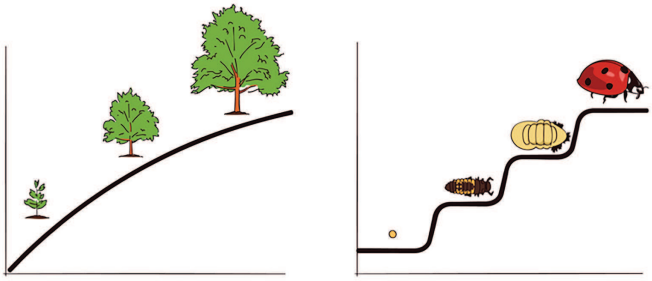

FIGURE 27.1. Continuous and discontinuous development. Some researchers see development as a continuous gradual process, much like a maple tree growing steadily in height and cross-sectional area. Other researchers see development as a progression of discontinuous stages, involving rapid discontinuous changes, such as those in the life cycle of a ladybug, separated by longer periods of slow, gradual change. ["Continuous and discontinuous development" by Robert Siegler/Noba is licensed under CC BY-NC-SA 4.0.]

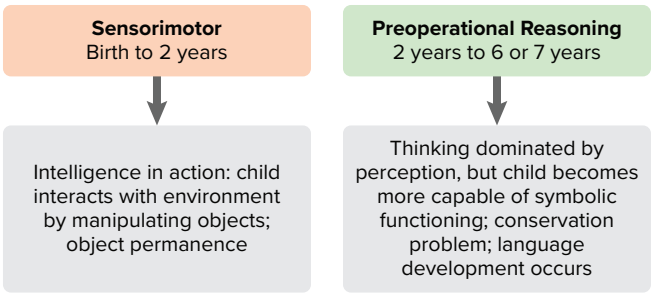

FIGURE 27.2. Piaget's sensorimotor and preoperational reasoning stages. [This work, "Sensorimotor and Preoperational Reasoning," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Piaget's Sensorimotor and Pre-operational Reasoning stages" by Robert Siegler/Noba, which is licensed under CC BY-NC-SA 4.0.]

the thinking within different stages differing in fundamental ways. The four stages that Piaget hypothesized were the **sensorimotor stage** (birth to 2 years), the **preoperational reasoning stage** (2 to 6 or 7 years), the **concrete operational reasoning stage** (6 or 7 to 11 or 12 years), and the **formal operational reasoning stage** (11 or 12 years and throughout the rest of life).

During the sensorimotor stage (FIGURE 27.2), children's thinking is largely realized through their perceptions of the world and their physical interactions with it. Their mental representations are very limited. Consider Piaget's **object permanence task**, which is one of his most famous problems. If an infant younger than 9 months of age is playing with a favorite toy, and another person removes the toy from view, for example by putting it under an opaque cover and not letting the infant immediately reach for it, the infant is very likely to make no effort to retrieve it and to show no emotional distress (Piaget, 1954). This is not due to their being uninterested in the toy or unable to reach for it; if the same toy is put under a clear cover, infants below 9 months readily retrieve it (Munakata et al., 1997). Instead, Piaget claimed that infants less than 9 months do not understand that objects continue to exist even when out of sight.

During the preoperational stage, according to Piaget (FIGURE 27.2), children can solve not only this simple problem (which they actually can solve after 9 months) but show a wide variety of other symbolic-representation capabilities, such as those involved in drawing and using language. However, such 2- to 7-year-olds tend to focus on a single dimension, even when solving problems would require them to consider multiple dimensions. This is evident in Piaget's (1952) **conservation problems**. For example, if a glass of water is poured into a taller, thinner glass, children below age 7 generally say that there now is more water than before. Similarly, if a clay ball is reshaped into a long, thin sausage, they claim that there is now more clay, and if a row of coins is spread out, they claim

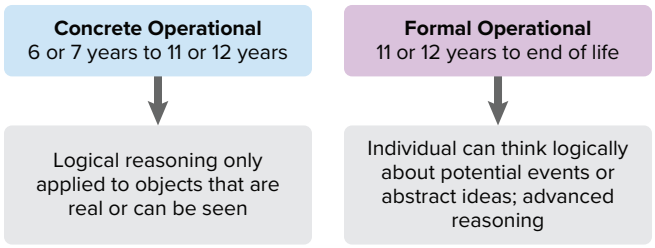

FIGURE 27.3. Piaget's concrete operational and formal operational stages. [This work, "Concrete Operational and Formal Operational," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Piaget's Concrete and Formal Operations stages" by Robert Siegler/Noba, which is licensed under CC BY-NC-SA 4.0.]

that there are now more coins. In all cases, the children are focusing on one dimension, while ignoring the changes in other dimensions (for example, the greater width of the glass and the clay ball).

Children overcome this tendency to focus on a single dimension during the concrete operations stage (**FIGURE 27.3**), and think logically in most situations. However, according to Piaget, they still cannot think in systematic scientific ways, even when such thinking would be useful. Thus, if asked to find out which variables influence the period that a pendulum takes to complete its arc, and given weights that they can attach to strings in order to do experiments with the pendulum to find out, most children younger than age 12 perform biased experiments from which no conclusion can be drawn, and then conclude that whatever they originally believed is correct. For example, if a boy believed that weight was the only variable that mattered, he might put the heaviest weight on the shortest string and push it the hardest, and then conclude that just as he thought, weight is the only variable that matters (Inhelder & Piaget, 1958).

Finally, in the formal operations period (**FIGURE 27.3**), children attain the reasoning power of mature adults, which allows them to solve the pendulum problem and a wide range of other problems. However, this formal operations stage tends not to occur without exposure to formal education in scientific reasoning and appears to be largely or completely absent from some societies that do not provide this type of education.

Although Piaget's theory has been very influential, it has not gone unchallenged. Many more recent researchers have obtained findings indicating that cognitive development is considerably more continuous than Piaget claimed. For example, Diamond (1985) found that on the object permanence task described above, infants show earlier knowledge if the waiting period is shorter. At age 6 months, they retrieve the hidden object if the wait is no longer than 2 seconds; at 7 months, they retrieve it if the wait is no longer than 4 seconds; and so on. Even earlier, at 3 or 4 months, infants show surprise in the form of longer looking times if objects suddenly appear to vanish with no obvious cause (Baillargeon 1987). Similarly, children's specific experiences can greatly influence when developmental changes occur. Children of pottery makers in Mexican villages, for example, know that reshaping clay does not change the amount of clay at much younger ages than children who do not have similar experiences (Price-Williams et al., 1969).

So, is cognitive development fundamentally continuous or fundamentally discontinuous? A reasonable answer seems to be, "It depends on how you look at it and how often you look." For example, under relatively facilitative circumstances, infants show early forms of object permanence by 3 or 4 months, and they gradually extend the range of times for which they can remember hidden objects as they grow older. However, on Piaget's original object permanence task, infants do quite quickly change toward the end of their first year from not reaching for hidden toys to reaching for them, even after they've experienced a substantial delay before being allowed to reach. Thus, the debate between those who emphasize discontinuous, stage-like changes in cognitive development and those who emphasize gradual continuous changes remains a lively one.

APPLICATIONS TO EDUCATION

Understanding how children think and learn has proven useful for improving education. One example comes from the area of reading. Cognitive developmental research has shown that **phonemic awareness**—that is, awareness of the component sounds within words—is a crucial skill in learning to read. To measure awareness of the component sounds within words, researchers ask children to decide whether two words rhyme, to decide whether the words start with the same sound, to identify the component sounds within words, and to indicate what would be left if a given sound were removed from a word. Kindergartners' performance on these tasks is the strongest predictor of reading achievement in third and fourth grade, even stronger than IQ or social class background (Nation, 2008). Moreover, teaching these skills to randomly chosen 4- and 5-year-olds results in their being better readers years later (National Reading Panel, 2000).

Another educational application of cognitive developmental research involves the area of mathematics. Even before they enter kindergarten, the mathematical knowledge of children from low-income backgrounds lags far behind that of children from more affluent backgrounds. Ramani and Siegler (2008) hypothesized that this difference is due to the children in middle- and upper-income families engaging more frequently in numerical activities, for example playing numerical board games such as **Chutes and Ladders**. Chutes and Ladders is a game with a number in each square; children

Activities like playing games that involve working with numbers and spatial relationships can give young children a developmental advantage over peers who have less exposure to the same concepts. ["Chutes & Ladders" by Amancay Blank/Flickr is licensed under CC BY-NC-ND 2.0.]

start at the number one and spin a spinner or throw a die to determine how far to move their token. Playing this game seemed likely to teach children about numbers, because in it, larger numbers are associated with greater values on a variety of dimensions. In particular, the higher the number that a child's token reaches, the greater the distance the token will have traveled from the starting point, the greater the number of physical movements the child will have made in moving the token from one square to another, the greater the number of number-words the child will have said and heard, and the more time will have passed since the beginning of the game. These spatial, kinesthetic, verbal, and time-based cues provide a broad-based, multisensory foundation for knowledge of **numerical magnitudes** (the sizes of numbers), a type of knowledge that is closely related to mathematics achievement test scores (Booth & Siegler, 2006).

Playing this numerical board game for roughly 1 hour, distributed over a 2-week period, improved low-income children's knowledge of numerical magnitudes, ability to read printed numbers, and skill at learning novel arithmetic problems. The gains lasted for months after the game-playing experience (Ramani & Siegler, 2008; Siegler & Ramani, 2009). An advantage of this type of educational intervention is that it has minimal if any cost—a parent could just draw a game on a piece of paper.

Understanding of cognitive development is advancing on many different fronts. One exciting area is linking changes in brain activity to changes in children's thinking (Nelson et al., 2006). Although many people believe that brain maturation is something that occurs before birth, the brain actually continues to change in large ways for many years thereafter. For example, a part of the brain called the prefrontal cortex, which is located at the front of the brain and is particularly involved with planning and flexible problem solving, continues to develop throughout adolescence (Blakemore & Choudhury, 2006). Such new research domains, as well as enduring issues such as nature and nurture, continuity and discontinuity, and how to apply cognitive development research to education, insure that cognitive development will continue to be an exciting area of research in the coming years.

CONCLUSION

Research into cognitive development has shown us that minds don't just form according to a uniform blueprint or innate intellect, but through a combination of influencing factors. For instance, if we want our kids to have a strong grasp of language, we could concentrate on phonemic awareness early on. If we want them to be good at math and science we could engage them in numerical games and activities early on. Perhaps most importantly, we no longer think of brains as empty vessels waiting to be filled up with knowledge but as adaptable organs that develop all the way through early adulthood.

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READING 28

Theories of Development

SOURCE

Levy, J. (2019). *Psychology: The science of human potential.* BCcampus. https://pressbooks.bccampus.ca/thescienceofhumanpotential/

LEARNING OBJECTIVE

- Relate control-learning principles to Kohlberg's stages of moral development.

KEY TERMS

appetitive outcomes
authoritarian parents
authoritative parents
aversive outcomes
conventional morality
indifferent parents
indulgent parents
post-conventional morality
pre-conventional morality

MORAL DEVELOPMENT

> *Children are completely egoistic; they feel their needs intensely and strive ruthlessly to satisfy them.*
>
> *It is impossible to overlook the extent to which civilization is built upon a renunciation of instinct.*
>
> *The first requisite of civilization is that of justice.*
>
> —Sigmund Freud

Frankenstein's monster understood the difference between "good" (e.g., food) and "bad" (e.g., fire). Unfortunately, he didn't have "right" and "wrong" down pat! Piaget's interests extended beyond the development of knowledge and skills related to nature (i.e., scientific thinking). He was also deeply interested in the individual's development of a moral code (Piaget, 1932). Not surprisingly, Piaget believed that the cognitive changes occurring as the child and teenager advanced through the developmental stages influenced their moral thinking as well as their understanding of nature. During the pre-verbal sensorimotor stage, direct learning principles account for changes in behavior. The child increases the frequency of behaviors resulting in **appetitive** (i.e., "feel good") or reducing **aversive** (i.e., "feel bad") outcomes and suppresses behaviors resulting in aversive or the loss of appetitive outcomes. As the child initially acquires language during the preoperational stage, rules are imposed by adults (primarily parents and caregivers) and understood in a literal, inflexible way. Later, the child gradually interacts with other children, makes friends, and goes to school. The parents' influence is diluted by the direct and indirect (i.e., observational and verbal) contingencies experienced with different adults (e.g., teachers, members of the clergy, etc.) and their peers. As the child becomes less egocentric during the stage of concrete operations, he/she is able to appreciate the perspectives of others and recognize the possibility and need to cooperate by negotiating rules of conduct. Once attaining the stage of formal operations, teenagers and adults are able to appreciate and consider more subtle and abstract aspects of interpersonal and moral issues (e.g., the benefits and need for fairness, justice, responsibility, etc.).

KOHLBERG'S STAGE MODEL OF MORAL DEVELOPMENT

Lawrence Kohlberg (1976) developed a very influential stage model of moral development based on Piaget's stage model of cognitive development (see **FIGURE 28.1**). He distinguished between three different levels ("styles") of reasoning: pre-conventional, conventional, and post-conventional, each sub-divided for a total of six stages. **Pre-conventional morality** is based upon extrinsic rewards and punishers. At first, during Piaget's sensorimotor period, the child is only sensitive to extrinsic rewards and punishers. Once the child acquires speech during Piaget's pre-operational stage, distinctions between right and wrong are taught by parents and other authority figures. The child learns the value of cooperation (e.g., "I'll scratch your back and you scratch mine") once making friends and interacting with others. **Conventional morality** is based on reference to an authority figure (e.g., parent, teacher, clergy member, etc.) at first and then advances to written sources (e.g., the Bible, the Koran, the Constitution, etc.). The child acquires a more abstract and flexible understanding of morality once progressing to the stages of concrete and formal operations. The highest (and rarest) **post-conventional morality** level is based on the application of universal principles such as the Golden Rule (Do unto others as you would have others do unto you).

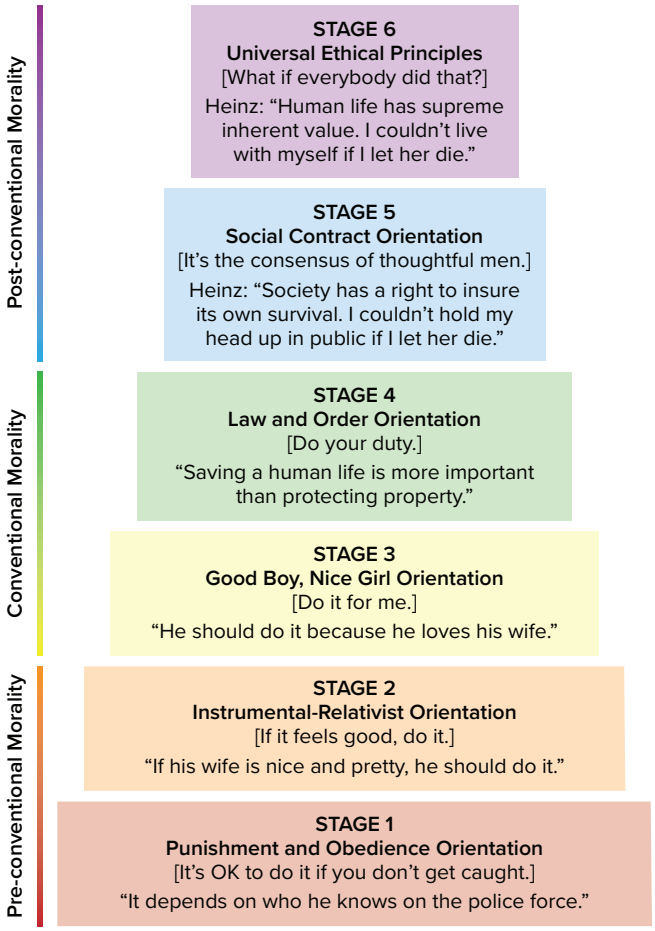

FIGURE 28.1. Kohlberg's stage theory of moral development. [This work, "Kohlberg's Model of Moral Development," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Kohlberg Model of Moral Development" by Lawrence Kohlberg and Em Griffin/Wikimedia Commons, which is in the public domain.]

In attempting to teach codes of moral conduct, much parenting consists of the intentional or non-intentional administration of appetitive and aversive events. We may consider how the different parental styles implement learning procedures and how they may relate to Kohlberg's levels of moral development (see **TABLE 28.1**).

Indifferent parents (low demandingness, low responsiveness) do not specify codes of conduct or respond to their children's needs. If other people (siblings, relatives, peers) do not provide rules and/or consequences, the children will most likely base right and wrong on the outcomes of their actions (if it feels good it is right; if it feels bad it is wrong). Indifferent parenting would appear to be most likely to produce pre-conventional reasoning in children.

Indulgent parents (low demandingness, high responsiveness) do not specify codes of conduct but are affectionate and responsive. They provide "unconditional positive regard" (Rogers, 1957), the type of non-contingent appetitive consequence likely to result in "spoiling" and a sense of entitlement. This could create problems for the children in other contexts (e.g., school, playgrounds) when others react differently to their behavior.

Authoritarian parents (high demandingness, low responsiveness) specify strict codes of conduct in a non-responsive manner. If the children ask for reasons, they may reply "because I say so!" In their parents' absence, the children would seek other sources of authority. The authoritarian parenting style would appear likely to result in conventional reasoning.

Authoritative parents (high demandingness, high responsiveness) specify strict codes of conduct within a context of warmth and sensitivity to the children's needs. They are likely to provide reasons for their codes of conduct, listen to their children's perspective, and in some instances, negotiate alternative codes. The authoritative style would likely result in post-conventional reasoning. Ideally, by providing reasons and explanations in age-appropriate language, our children would internalize principles of moral conduct and apply them appropriately throughout their lives.

It is very difficult to administer punishment immediately and on a consistent basis in the natural, free-living environment. Therefore, it is not likely that punishment will work as intended, to suppress undesired behavior. Often, instead, the child will learn to become deceptive or lie in order to avoid being punished. Indifferent parents are not likely to be present to appropriately administer punishment and will probably be inconsistent. Indulgent parents are less likely to administer punishment than other parents, if at all. Authoritarian parents ("my way or the highway") might effectively suppress

TABLE 28.1. Parental Styles and Stages of Morality

Indifferent	Indulgent	Authoritarian	Authoritative
Unavailable to monitor behavior, administer consequences consistently, or provide explanations	Available to administer non-contingent presentation of appetitive events and provide praise	Available to administer contingent presentation of mostly aversive events without explanation	Available to administer contingent presentation of appetitive and aversive events with explanation
Pre-conventional morality	Sense of entitlement	Conventional morality	Post-conventional morality

Adapted from Levy (2013).

the undesired behavior when they are present. However, the behavior may occur when they are not present or when the child is in different situations. Authoritative parents, taking advantage of their children's verbal and reasoning skills, probably have the greatest likelihood of attaining the desired result. For example, an older sibling picking on a younger one might be told the following scenario which includes stipulation of rules of conduct:

> There is a difference between a jungle and a society. In the jungle, strong animals often attack weaker animals who receive no protection. Human beings have families and societies in which the strong protect the weak and help them grow stronger. You have to decide whether you want to live in our family and be a member of society. If you keep picking on your little brother/sister, we will need to treat you like an animal from the jungle. We put dangerous animals in a zoo so they cannot hurt anyone, so we will keep you in your room. If you take care of your little brother/sister, mommy and daddy will let you play together and have fun.

By relying upon language to stipulate and enforce rules in this manner, a parent is most likely to achieve the short-term objective of encouraging appropriate and discouraging inappropriate behavior. In addition, by providing thoughtful explanations and justifications of rules, the parent increases the likelihood that the child will internalize a moral code of conduct as he/she matures.

ERIK ERIKSON'S STAGE THEORY OF LIFESPAN DEVELOPMENT

Erik Erikson (1950; 1959) proposed a "cradle to grave" sequence of development that complements the stage theories of Piaget and Kohlberg. Erikson described eight "conflicts" associated with different periods of one's life (see **TABLE 28.2**). It was assumed that successful resolution of the conflict associated with a particular stage resulted in acquisition of the related "virtue" (e.g., trust, autonomy, initiative, etc.) for the rest of one's life. Unsuccessful resolution would result in developmental problems during subsequent stages.

CHILDHOOD

During Erikson's first (infancy) stage, taking place during Piaget's pre-verbal sensorimotor stage, the attachment style of the caregiver will influence whether or not the infant experiences a nurturing and responsive social environment. If the caregiver is consistent in satisfying the basic needs for food, comfort, and relief from pain, the infant learns to trust them. If negligent, inconsistent, or abusive, the child will mistrust and perhaps fear the caregiver.

In the second (early childhood) stage, starting toward the end of Piaget's sensorimotor stage and extending into the beginning of the verbal preoperational stage, the young child is exploring and learning to control the environment on its own. A patient caregiver waits until the zone of proximal

TABLE 28.2. Erikson's Eight Stages of Human Development

Erickson's Psychosocial Stages			
Stages	**Crisis**	**Favorable Outcome**	**Unfavorable Outcome**
Childhood			
1st year of life	Trust vs. mistrust	Faith in the environment and future events	Suspicion, fear of future events
2nd year	Autonomy vs. doubt	A sense of self-control and adequacy	Feelings of shame and self-doubt
3rd through 5th years	Initiative vs. guilt	Ability to be a "self-starter," to initiate one's own activities	A sense of guilt and inadequacy to be on one's own
6th year to puberty	Industry vs. inferiority	Ability to learn how things work, to understand and organize	A sense of inferiority at understanding and organizing
Transition Years			
Adolescence	Identity vs. confusion	Seeing oneself as a unique and integrated person	Confusion over who and what one really is
Adulthood			
Early adulthood	Intimacy vs. isolation	Ability to make commitments to others, to love	Inability to form affectionate relationship
Middle age	Generativity vs. self-absorption	Concern for family and society in general	Concern only for self—one's own well-being and prosperity
Aging years	Integrity vs. despair	A sense of integrity and fulfillment; willingness to face death	Dissatisfaction with life; despair over prospect of death

development is reached and applies encouraging, supportive scaffolding techniques during toilet training and other learning experiences. Such a parent is likely to insure the child's success, resulting in the feeling of independence and autonomy. If the child is hurried, scolded, or punished for failures, she/he may feel shame and doubt her/his capabilities.

In the third (preschool) stage, occurring in the middle of Piaget's preoperational stage, the child must learn to dress and groom in a manner consistent with social norms and standards. If the child is encouraged to explore options, satisfy its curiosity, and express its own preferences and interests, it is likely to develop initiative. If discouraged, the child may become passive and doubtful of its own capabilities and experience guilt regarding its choices.

Erikson's lengthy fourth (school age) stage starts toward the end of Piaget's preoperational stage and extends through concrete operations into the beginning of the final formal operations stage. If at home and school, the child is appropriately challenged and succeeds at progressively more difficult tasks, it becomes competent, confident, and industrious. The child must experience and learn to cope with frustration and inevitable failure. It is during this stage that the child becomes concerned about its own performance in comparison to others in and out of school. Feelings of inferiority can result from perceived inadequacies and negative social comparisons.

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READING 29

Attachment Through the Life Course

R. Chris Fraley

SOURCE

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LEARNING OBJECTIVES

- Explain the way the attachment system works and its evolutionary significance.
- Identify three commonly studied attachment patterns and what is known about the development of those patterns.
- Describe what is known about the consequences of secure versus insecure attachment in adult relationships.

KEY TERMS

attachment behavioral system
attachment behaviors
attachment figure
attachment patterns
strange situation

The purpose of this module is to provide a brief review of attachment theory—a theory designed to explain the significance of the close, emotional bonds that children develop with their caregivers and the implications of those bonds for understanding personality development. The module discusses the origins of the theory, research on individual differences in attachment security in infancy and childhood, and the role of attachment in adult relationships.

INTRODUCTION

Some of the most rewarding experiences in people's lives involve the development and maintenance of close relationships. For example, some of the greatest sources of joy involve falling in love, starting a family, being reunited with distant loved ones, and sharing experiences with close others. And, not surprisingly, some of the most painful experiences in people's lives involve the disruption of important social bonds, such as separation from a spouse, losing a parent, or being abandoned by a loved one.

Close relationships are the fabric of society and are integral to the maintenance of our species. ["Sleeping Man and Baby in Close-up Photography" by Quaries.com/Flickr is licensed under CC BY 2.0.]

Why do close relationships play such a profound role in human experience? Attachment theory is one approach to understanding the nature of close relationships. In this module, we review the origins of the theory, the core theoretical principles, and some ways in which attachment influences human behavior, thoughts, and feelings across the life course.

ATTACHMENT THEORY: A BRIEF HISTORY AND CORE CONCEPTS

Attachment theory was originally developed in the 1940s by John Bowlby, a British psychoanalyst who was attempting to understand the intense distress experienced by infants who had been separated from their parents. Bowlby (1969) observed that infants would go to extraordinary lengths to prevent separation from their parents or to reestablish proximity to a missing parent. For example, he noted that children who had been separated from their parents would often cry, call for their parents, refuse to eat or play, and stand at the door in desperate anticipation of their parents' return. At the time of Bowlby's initial writings, psychoanalytic writers held that these expressions were manifestations of immature defense mechanisms that were operating to repress emotional pain. However, Bowlby observed that such expressions are common to a wide variety of mammalian species and speculated

FOCUS TOPIC 1

Harlow's Research on Contact Comfort

When Bowlby was originally developing his theory of attachment, there were alternative theoretical perspectives on why infants were emotionally attached to their primary caregivers (most often, their biological mothers). Bowlby and other theorists, for example, believed that there was something important about the responsiveness and contact provided by mothers. Other theorists, in contrast, argued that young infants feel emotionally connected to their mothers because mothers satisfy more basic needs, such as the need for food. That is, the child comes to feel emotionally connected to the mother because she is associated with the reduction of primary drives, such as hunger, rather than the reduction of drives that might be relational in nature.

In a classic set of studies, psychologist Harry Harlow placed young monkeys in cages that contained two artificial, surrogate "mothers" (Harlow, 1958). One of those surrogates was a simple wire contraption; the other was a wire contraption covered in cloth. Both of the surrogate mothers were equipped with a feeding tube so that Harrow and his colleagues had the option to allow the surrogate to deliver or not deliver milk. Harlow found that the young macaques spent a disproportionate amount of time with the cloth surrogate as opposed to the wire surrogate. Moreover, this was true even when the infants were fed by the wire surrogate rather than the cloth surrogate. This suggests that the strong emotional bond that infants form with their primary caregivers is rooted in something more than whether the caregiver provides food per se. Harlow's research is now regarded as one of the first experimental demonstrations of the importance of "contact comfort" in the establishment of infant–caregiver bonds. ■

that these responses to separation may serve an evolutionary function (see Focus Topic 1).

Drawing on evolutionary theory, Bowlby (1969) argued that these behaviors are adaptive responses to separation from a primary **attachment figure**—a caregiver who provides support, protection, and care. Because human infants, like other mammalian infants, cannot feed or protect themselves, they are dependent upon the care and protection of "older and wiser" adults for survival. Bowlby argued that, over the course of evolutionary history, infants who were able to maintain proximity to an attachment figure would be more likely to survive to a reproductive age.

According to Bowlby, a motivational system, what he called the **attachment behavioral system**, was gradually "designed" by natural selection to regulate proximity to an attachment figure. The attachment system functions much like a thermostat that continuously monitors the ambient temperature of a room, comparing that temperature against a desired state and adjusting behavior (e.g., activating the furnace) accordingly. In the case of the attachment system, Bowlby argued that the system continuously monitors the accessibility of the primary attachment figure. If the child perceives the attachment figure to be nearby, accessible, and attentive, then the child feels loved, secure, and confident and, behaviorally, is likely to explore his or her environment, play with others, and be sociable. If, however, the child perceives the attachment figure to be inaccessible, the child experiences anxiety and, behaviorally, is likely to exhibit attachment behaviors ranging from simple visual searching on the low extreme to active searching, following, and vocal signaling on the other. These **attachment behaviors** continue either until the child is able to reestablish a desirable level of physical or psychological proximity to the attachment figure or until the child exhausts himself or herself or gives up, as may happen in the context of a prolonged separation or loss.

INDIVIDUAL DIFFERENCES IN INFANT ATTACHMENT

Although Bowlby believed that these basic dynamics captured the way the attachment system works in most children, he recognized that there are individual differences in the way children appraise the accessibility of the attachment figure and how they regulate their attachment behavior in response to threats. However, it was not until his colleague, Mary Ainsworth, began to systematically study infant–parent separations that a formal understanding of these individual differences emerged. Ainsworth and her students developed a technique called the **strange situation**—a laboratory task for studying infant–parent attachment (Ainsworth et al., 1978). In the strange situation, 12-month-old infants and their parents are brought to the laboratory and, over a period of approximately 20 minutes, are systematically separated from and reunited with one another. In the strange situation, most children (about 60%) behave in the way implied by Bowlby's normative theory. Specifically, they become upset when the parent leaves the room, but, when he or she returns, they actively seek the parent and are easily comforted by him or her. Children who exhibit this pattern of behavior are often called *secure*. Other children (about 20% or less) are ill at ease initially and, upon separation, become extremely distressed. Importantly, when reunited with their parents, these children have a difficult time being soothed and often exhibit conflicting behaviors that suggest they want to be comforted, but that

Think of your earliest memory. Does it involve just you, or does it include your loved ones, your family and caretakers? ["supermarket-1593131" by leeson zeng/Pixabay is in the public domain under CC0 1.0.]

Is attachment style multi-generational? How does one person's childhood attachment style translate to the way that person interacts with his or her own children? ["Flower Hmong mother and baby" by Linda De Volder/Flickr is licensed under CC BY-NC-ND 2.0.]

they also want to "punish" the parent for leaving. These children are often called *anxious-resistant*. The third pattern of attachment that Ainsworth and her colleagues documented is often labeled *avoidant*. Avoidant children (about 20%) do not consistently behave as if they are stressed by the separation but, upon reunion, actively avoid seeking contact with their parent, sometimes turning their attention to play objects on the laboratory floor.

Ainsworth's work was important for at least three reasons. First, she provided one of the first empirical demonstrations of how attachment behavior is organized in unfamiliar contexts. Second, she provided the first empirical taxonomy of individual differences in infant **attachment patterns**. According to her research, at least three types of children exist: those who are secure in their relationship with their parents, those who are anxious-resistant, and those who are avoidant. Finally, she demonstrated that these individual differences were correlated with infant–parent interactions in the home during the first year of life. Children who appear secure in the strange situation, for example, tend to have parents who are responsive to their needs. Children who appear insecure in the strange situation (i.e., anxious-resistant or avoidant) often have parents who are insensitive to their needs or inconsistent or rejecting in the care they provide.

ANTECEDENTS OF ATTACHMENT PATTERNS

In the years that have followed Ainsworth's ground-breaking research, researchers have investigated a variety of factors that may help determine whether children develop secure or insecure relationships with their primary attachment figures. As mentioned above, one of the key determinants of attachment patterns is the history of sensitive and responsive interactions between the caregiver and the child. In short, when the child is uncertain or stressed, the ability of the caregiver to provide support to the child is critical for his or her psychological development. It is assumed that such supportive interactions help the child learn to regulate his or her emotions, give the child the confidence to explore the environment, and provide the child with a safe haven during stressful circumstances.

Evidence for the role of sensitive caregiving in shaping attachment patterns comes from longitudinal and experimental studies. For example, Grossmann et al. (1985) studied parent–child interactions in the homes of 54 families up to three times during the first year of the child's life. At 12 months of age, infants and their mothers participated in the strange situation. Grossmann and her colleagues found that children who were classified as secure in the strange situation at 12 months of age were more likely than children classified as insecure to have mothers who provided responsive care to their children in the home environment.

Dymphna van den Boom (1994) developed an intervention that was designed to enhance maternal sensitive responsiveness. When their infants were 9 months of age, the mothers in the intervention group were rated as more responsive and attentive in their interaction with the infants compared to mothers in the control group. In addition, their infants were rated as more sociable, more self-soothing, and more likely to explore the environment. At 12 months of age, children in the intervention group were more likely to be classified as secure than insecure in the strange situation.

ATTACHMENT PATTERNS AND CHILD OUTCOMES

Attachment researchers have studied the association between children's attachment patterns and their adaptation over time. Researchers have learned, for example, that children who are classified as secure in the strange situation are more likely to

have high functioning relationships with peers, to be evaluated favorably by teachers, and to persist with more diligence in challenging tasks. In contrast, insecure-avoidant children are more likely to be construed as "bullies" or to have a difficult time building and maintaining friendships (Weinfield et al., 2008).

ATTACHMENT IN ADULTHOOD

Although Bowlby was primarily focused on understanding the nature of the infant–caregiver relationship, he believed that attachment characterized human experience across the life course. It was not until the mid-1980s, however, that researchers began to take seriously the possibility that attachment processes may be relevant to adulthood. Hazan and Shaver (1987) were two of the first researchers to explore Bowlby's ideas in the context of romantic relationships. According to Hazan and Shaver, the emotional bond that develops between adult romantic partners is partly a function of the same motivational system—the attachment behavioral system—that gives rise to the emotional bond between infants and their caregivers. Hazan and Shaver noted that in both kinds of relationship, people (a) feel safe and secure when the other person is present; (b) turn to the other person during times of sickness, distress, or fear; (c) use the other person as a "secure base" from which to explore the world; and (d) speak to one another in a unique language, often called "motherese" or "baby talk." (See Focus Topic 2.)

On the basis of these parallels, Hazan and Shaver (1987) argued that adult romantic relationships, similar to infant–caregiver relationships, are attachments. According to Hazan and Shaver, individuals gradually transfer attachment-related functions from parents to peers as they develop. Thus, although young children tend to use their parents as their primary attachment figures, as they reach adolescence and young adulthood, they come to rely more upon close friends and/or romantic partners for basic attachment-related functions. Thus, although a young child may turn to his or her mother for comfort, support, and guidance when distressed, scared, or ill, young adults may be more likely to turn to their romantic partners for these purposes under similar situations.

Hazan and Shaver (1987) asked a diverse sample of adults to read the three paragraphs below and indicate which paragraph best characterized the way they think, feel, and behave in close relationships:

1. I am somewhat uncomfortable being close to others; I find it difficult to trust them completely, difficult to allow myself to depend on them. I am nervous when anyone gets too close, and often, others want me to be more intimate than I feel comfortable being.
2. I find it relatively easy to get close to others and am comfortable depending on them and having them depend on me. I don't worry about being abandoned or about someone getting too close to me.
3. I find that others are reluctant to get as close as I would like. I often worry that my partner doesn't really love me or won't want to stay with me. I want to get very close to my partner, and this sometimes scares people away.

Conceptually, these descriptions were designed to represent what Hazan and Shaver considered to be adult analogues of the kinds of attachment patterns Ainsworth described in the strange situation (avoidant, secure, and anxious, respectively). Hazan and Shaver (1987) found that the distribution of the three patterns was similar to that observed in infancy. In other words, about 60% of adults classified themselves as secure (paragraph B), about 20% described themselves as avoidant (paragraph A), and about 20% described themselves as anxious-resistant (paragraph C). Moreover, they found that

FOCUS TOPIC 2

Attachment and Social Media

Social media websites and mobile communication services play an increasing role in people's lives. Many people use Facebook, for example, to keep in touch with family and friends, to update their loved ones regarding things going on in their lives, and to meet people who share similar interests. Moreover, modern cellular technology allows people to get in touch with their loved ones much easier than was possible a mere 20 years ago.

From an attachment perspective, these innovations in communications technology are important because they allow people to stay connected virtually to their attachment figures—regardless of the physical distance that might exist between them. Recent research has begun to examine how attachment processes play out in the use of social media. Oldmeadow et al. (2013), for example, studied a diverse sample of individuals and assessed their attachment security and their use of Facebook. Oldmeadow and his colleagues found that the use of Facebook may serve attachment functions. For example, people were more likely to report using Facebook to connect with others when they were experiencing negative emotions. In addition, the researchers found that people who were more anxious in their attachment orientation were more likely to use Facebook frequently, but people who were more avoidant used Facebook less and were less open on the site. ■

people who described themselves as secure, for example, were more likely to report having had warm and trusting relationships with their parents when they were growing up. In addition, they were more likely to have positive views of romantic relationships. Based on these findings, Hazan and Shaver (1987) concluded that the same kinds of individual differences that exist in infant attachment also exist in adulthood.

Research on Attachment in Adulthood

Attachment theory has inspired a large amount of literature in social, personality, and clinical psychology. In the sections below, I provide a brief overview of some of the major research questions and what researchers have learned about attachment in adulthood.

Who Ends Up with Whom?

When people are asked what kinds of psychological or behavioral qualities they are seeking in a romantic partner, a large majority of people indicate that they are seeking someone who is kind, caring, trustworthy, and understanding—the kinds of attributes that characterize a "secure" caregiver (Chappell & Davis, 1998). But we know that people do not always end up with others who meet their ideals. Are secure people more likely to end up with secure partners—and, vice versa, are insecure people more likely to end up with insecure partners? The majority of the research that has been conducted to date suggests that the answer is "yes." Frazier et al. (1996), for example, studied the attachment patterns of more than 83 heterosexual couples and found that, if the man was relatively secure, the woman was also likely to be secure.

One important question is whether these findings exist because (a) secure people are more likely to be attracted to other secure people, (b) secure people are likely to create security in their partners over time, or (c) some combination of these possibilities. Existing empirical research strongly supports the first alternative. For example, when people have the opportunity to interact with individuals who vary in security in a speed-dating context, they express a greater interest in those who are higher in security than those who are more insecure (McClure et al., 2010). However, there is also some evidence that people's attachment styles mutually shape one another in close relationships. For example, in a longitudinal study, Hudson et al. (2014) found that, if one person in a relationship experienced a change in security, his or her partner was likely to experience a change in the same direction.

People who had relatively secure attachments as children go on to have more secure romantic attachments. ["couple-1822585" by Sasin Tipchai/Pixabay is in the public domain under CC0 1.0.]

Relationship Functioning

Research has consistently demonstrated that individuals who are relatively secure are more likely than insecure individuals to have high functioning relationships—relationships that are more satisfying, more enduring, and less characterized by conflict. For example, Feeney and Noller (1992) found that insecure individuals were more likely than secure individuals to experience a breakup of their relationship. In addition, secure individuals are more likely to report satisfying relationships (e.g., Collins & Read, 1990) and are more likely to provide support to their partners when their partners are feeling distressed (Simpson et al., 1992).

Do Early Experiences Shape Adult Attachment?

The majority of research on this issue is retrospective—that is, it relies on adults' reports of what they recall about their childhood experiences. This kind of work suggests that secure adults are more likely to describe their early childhood experiences with their parents as being supportive, loving, and kind (Hazan & Shaver, 1987). A number of longitudinal studies are emerging that demonstrate prospective associations between early attachment experiences and adult attachment styles and/or interpersonal functioning in adulthood. For example, Fraley et al. (2013) found in a sample of more than 700 individuals studied from infancy to adulthood that maternal sensitivity across development prospectively predicted security at age 18. Simpson et al. (2007) found that attachment security, assessed in infancy in the strange situation, predicted peer competence in grades 1 to 3, which, in turn, predicted the quality of friendship relationships at age 16, which, in turn, predicted the expression of positive and negative emotions in their adult romantic relationships at ages 20 to 23.

It is easy to come away from such findings with the mistaken assumption that early experiences "determine" later outcomes. To be clear: Attachment theorists assume that the relationship between early experiences and subsequent outcomes is probabilistic, not deterministic. Having supportive and responsive experiences with caregivers early in life is assumed to set the stage for positive social development.

Sharing food, celebrations, and traditions are some of the ways we establish secure attachments with our loved ones from an early age. ["Thanksgiving Dinner in Penticton" by iwona_kellie/Flickr is licensed under CC BY-NC-SA 2.0.]

But that does not mean that attachment patterns are set in stone. In short, even if an individual has far from optimal experiences in early life, attachment theory suggests that it is possible for that individual to develop well-functioning adult relationships through a number of corrective experiences—including relationships with siblings, other family members, teachers, and close friends. Security is best viewed as a culmination of a person's attachment history rather than a reflection of his or her early experiences alone. Those early experiences are considered important not because they determine a person's fate, but because they provide the foundation for subsequent experiences.

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READING 30

Research Methods in Developmental Psychology

Angela Lukowski and Helen Milojevich

SOURCE

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LEARNING OBJECTIVES

- Describe different research methods used to study infant and child development.
- Discuss different research designs, as well as their strengths and limitations.
- Report on the unique challenges associated with conducting developmental research.

KEY TERMS

assent
attrition
bidirectional relations
cohort effects
cross-sectional research designs
dishabituation
elicited imitation
event-related potentials
habituation
informed consent
Institutional Review Boards (IRBs)
interview techniques
involuntary or obligatory responses
longitudinal research designs
motor control
object permanence
practice effects
psychophysiological responses
recall memory
research design
research methods
sequential research designs
solidity principle
verbal report paradigms
vignette
violation of expectation paradigm
voluntary responses

What do infants know about the world in which they live—and how do they grow and change with age? These are the kinds of questions answered by developmental scientists. This module describes different research techniques that are used to study psychological phenomena in infants and children, research designs that are used to examine age-related changes in development, and unique challenges and special issues associated with conducting research with infants and children. Child development is a fascinating field of study, and many interesting questions remain to be examined by future generations of developmental scientists—maybe you will be among them!

INTRODUCTION

A group of children were playing hide-and-seek in the yard. Pilar raced to her hiding spot as her 6-year-old cousin, Lucas, loudly counted, ". . . six, seven, eight, nine, ten! Ready or not, here I come!" Pilar let out a small giggle as Lucas ran over to find her—in the exact location where he had found his sister a short time before. At first glance, this behavior is puzzling: why would Pilar hide in exactly the same location where someone else was just found? Whereas older children and adults realize that it is likely best to hide in locations that have not been searched previously, young children do not have the same cognitive sophistication. But why not . . . and when do these abilities first develop?

Developmental psychologists investigate questions like these using research methods that are tailored to the particular capabilities of the infants and children being studied. Importantly, research in developmental psychology is more than simply examining how children behave during games of hide-and-seek—the results obtained from developmental research have been used to inform best practices in parenting, education, and policy.

This module describes different *research techniques* that are used to study psychological phenomena in infants and children, *research designs* that are used to examine age-related changes in developmental processes and changes over time, and *unique challenges and special issues* associated with conducting research with infants and children.

RESEARCH METHODS

Infants and children—especially younger children—cannot be studied using the same *research methods* used in studies

Children's games are more than just fun. They can be opportunities for researchers to learn about how children think, feel, and behave. ["Hide and Seek" by srietzke/Flickr is licensed under CC BY-NC 2.0.]

with adults. Researchers, therefore, have developed many creative ways to collect information about infant and child development. In this section, we highlight some of the methods that have been used by researchers who study infants and older children, separating them into three distinct categories: involuntary or obligatory responses, voluntary responses, and psychophysiological responses. We will also discuss other methods such as the use of surveys and questionnaires. At the end of this section, we give an example of how **interview techniques** can be used to study the beliefs and perceptions of older children and adults—a method that cannot be used with infants or very young children.

Involuntary or Obligatory Responses

One of the primary challenges in studying very young infants is that they have limited **motor control**—they cannot hold their heads up for short amounts of time, much less grab an interesting toy, play the piano, or turn a door knob. As a result, infants cannot actively engage with the environment in the same way as older children and adults. For this reason, developmental scientists have designed research methods that assess **involuntary or obligatory responses**. These are behaviors in which people engage without much conscious thought or effort. For example, think about the last time you heard your name at a party—you likely turned your head to see who was talking without even thinking about it. Infants and young children also demonstrate involuntary responses to stimuli in the environment. When infants hear the voice of their mother, for instance, their heart rate increases—whereas if they hear the voice of a stranger, their heart rate decreases (Kisilevsky et al., 2003). Researchers study involuntary behaviors to better understand what infants know about the world around them.

One research method that capitalizes on involuntary or obligatory responses is a procedure known as **habituation**. In habituation studies, infants are presented with a stimulus such as a photograph of a face over and over again until they become bored with it. When infants become bored, they look away from the picture. If infants are then shown a new picture—such as a photograph of a different face—their interest returns and they look at the new picture. This is a phenomenon known as **dishabituation**. Habituation procedures work because infants generally look longer at novel stimuli relative to items that are familiar to them. This research technique takes advantage of involuntary or obligatory responses because infants are constantly looking around and observing their environments; they do not have to be taught to engage with the world in this way.

One classic habituation study was conducted by Baillargeon and colleagues (1985). These researchers were interested in the concept of **object permanence**, or the understanding that objects exist even when they cannot be seen or heard. For example, you know your toothbrush exists even though you are probably not able to see it right this second. To investigate object permanence in 5-month-old infants, the researchers used a **violation of expectation paradigm**. The researchers first habituated infants to an opaque screen that moved back and forth like a drawbridge (using the same procedure you just learned about in the previous paragraph). Once the infants were bored with the moving screen, they were shown two different scenarios to test their understanding of physical events. In both of these test scenarios, an opaque box was placed behind the moving screen. What differed between these two scenarios, however, was whether they confirmed or violated the **solidity principle**—the idea that two solid objects cannot occupy the same space at the same time. In the *possible* scenario, infants watched as the moving drawbridge

Even when infants are so young that they have very little motor control, researchers can observe and record involuntary responses, such as an infant's eye movements, to get valuable insight into what they understand about the world around them. ["The look" by Jerald Guillermo/Flickr is licensed under CC BY-NC-ND 2.0.]

stopped when it hit the opaque box (as would be expected based on the solidity principle). In the *impossible* scenario, the drawbridge appeared to move right through the space that was occupied by the opaque box! This impossible scenario violates the solidity principle in the same way as if you got out of your chair and walked through a wall, reappearing on the other side.

The results of this study revealed that infants looked longer at the impossible test event than at the possible test event. The authors suggested that the infants reacted in this way because they were surprised—the demonstration went against their expectation that two solids cannot move through one another. The findings indicated that 5-month-old infants understood that the box continued to exist even when they could not see it. Subsequent studies indicated that 3½- and 4½-month-old infants also demonstrate object permanence under similar test conditions (Baillargeon, 1987). These findings are notable because they suggest that infants understand object permanence much earlier than had been reported previously in research examining voluntary responses (although see more recent research by Cashon & Cohen, 2000).

Voluntary Responses

As infants and children age, researchers are increasingly able to study their understanding of the world through their voluntary responses. **Voluntary responses** are behaviors that a person completes by choice. For example, think about how you act when you go to the grocery store: you select whether to use a shopping cart or a basket, you decide which sections of the store to walk through, and you choose whether to stick to your grocery list or splurge on a treat. Importantly, these behaviors are completely up to you (and are under your control). Although they do not do a lot of grocery shopping, infants and children also have voluntary control over their actions. Children, for instance, choose which toys to play with.

Researchers study the voluntary responses of infants and young children in many ways. For example, developmental scientists study **recall memory** in infants and young children by looking at voluntary responses. Recall memory is memory of past events or episodes, such as what you did yesterday

Filling your basket at the supermarket is an example of a voluntary response behavior. The choices you make are under your control. ["tomatoes" by ikayama/Flickr is licensed under CC BY-NC-SA 2.0.]

afternoon or on your last birthday. Whereas older children and adults are simply asked to talk about their past experiences, recall memory has to be studied in a different way in infants and very young children who cannot discuss the past using language. To study memory in these subjects, researchers use a behavioral method known as **elicited imitation** (Lukowski & Milojevich, 2016).

In the elicited imitation procedure, infants play with toys that are designed in the lab to be unlike the kinds of things infants usually have at home. These toys (or event sequences, as researchers call them) can be put together in a certain way to produce an outcome that infants commonly enjoy. One of these events is called Find the Surprise. As shown in **FIGURE 30.1**, this toy has a door on the front that is held in place by a latch—and a small plastic figure is hidden on the inside. During the first part of the study, infants play with the toy in whichever way they want for a few minutes. The researcher then shows the infant how make the toy work by (1) flipping the latch out of the way and (2) opening the door, revealing the plastic toy inside. The infant is allowed to play with the toy again either immediately after the demonstration or after a longer delay. As the infant plays, the researcher records

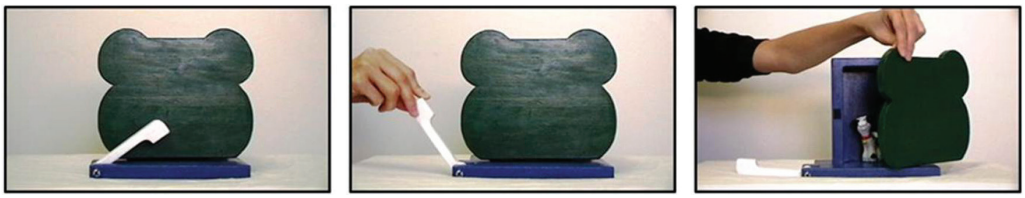


FIGURE 30.1. The two-step event sequence Find the Surprise. *Left,* All of the toys needed to complete the event. *Center,* A hand flips the latch out of the way so the door can be opened (step 1). *Right,* A hand opens the door, ultimately revealing a plastic figurine hidden inside (step 2). [These images are from a larger figure initially published in Lukowski and Milojevich (2013). Reprinted with permission.]

whether the infant finds the surprise using the same procedure that was demonstrated.

Use of the elicited imitation procedure has taught developmental scientists a lot about how recall memory develops. For example, we now know that 6-month-old infants remember one step of a 3-step sequence for 24 hours (Barr et al., 1996; Collie & Hayne, 1999). Nine-month-olds remember the individual steps that make up a 2-step event sequence for 1 month, but only 50% of infants remember to do the first step of the sequence before the second (Bauer et al., 2001, 2003; Carver & Bauer, 1999). When children are 20 months old, they remember the individual steps and temporal order of 4-step events for at least 12 months—the longest delay that has been tested to date (Bauer et al., 2000).

Psychophysiology

Behavioral studies have taught us important information about what infants and children know about the world. Research on behavior alone, however, cannot tell scientists how brain development or biological changes impact (or are impacted by) behavior. For this reason, researchers may also record data about **psychophysiological responses**, such as heart rate, hormone levels, or brain activity. These measures may be recorded by themselves or in combination with behavioral data to better understand the **bidirectional relations** between biology and behavior.

One manner of understanding associations between brain development and behavioral advances is through the recording of **event-related potentials**, or ERPs. ERPs are recorded by fitting a research participant with a stretchy cap that contains many small sensors or electrodes. These electrodes record tiny electrical currents on the scalp of the participant in response to the presentation of particular stimuli, such as a picture or a sound (for additional information on recording ERPs from infants and children, see DeBoer et al., 2005). The recorded responses are then amplified thousands of times using specialized equipment so that they look like squiggly lines with peaks and valleys. Some of these brain responses have been linked to psychological phenomena. For example, researchers have identified a negative peak in the recorded waveform that they have called the N170 (Bentin et al., 2010). The peak is named in this way because it is negative (hence the N) and because it occurs about 140 ms to 170 ms after a stimulus is presented (hence the 170). This peak is particularly sensitive to the presentation of faces, as it is commonly more negative when participants are presented with photographs of faces rather than with photographs of objects. In this way, researchers are able to identify brain activity associated with real-world thinking and behavior.

The use of ERPs has provided important insight as to how infants and children understand the world around them. In one study (Webb et al., 2006), researchers examined face and object processing in children with autism spectrum disorders, those with developmental delays, and those who were typically developing. The children wore electrode caps and had their brain activity recorded as they watched still photographs of faces (of their mother or of a stranger) and objects (including those that were familiar or unfamiliar to them). The researchers examined differences in face and object processing by group by observing a component of the brainwave they called the prN170 (because it was believed to be a precursor to the adult N170). Their results showed that the height of the prN170 peak (commonly called the *amplitude*) did not differ when faces or objects were presented to typically developing children. When considering children with autism, however, the peaks were higher when objects were presented relative to when faces were shown. Differences were also found in how long it took the brain to reach the negative peak (commonly called the *latency* of the response). Whereas the peak was reached more quickly when typically developing children were presented with faces relative to objects, the opposite was true for children with autism. These findings suggest that children with autism are in some way processing faces differently than typically developing children (and, as reported in the manuscript, children with more general developmental delays).

Special equipment has been developed to allow researchers to record the brain activity of very young and very small research subjects. ["Infant EEG Cap Mannequin" by Matt Cain/Flickr is licensed under CC BY-NC-SA 2.0.]

Parent-Report Questionnaires

Developmental science has come a long way in assessing various aspects of infant and child development through behavior and psychophysiology—and new advances are happening every day. In many ways, however, the very youngest

Parents spend countless hours together with children observing their behavior. Developmental psychologists sometimes use surveys to collect information from parents that can be used to answer important research questions. ["DSC01065_1" by Jerry Lai/ Flickr is licensed under CC BY-NC-SA 2.0.]

of research participants are still quite limited in the information they can provide about their own development. As such, researchers often ask the people who know infants and children best—commonly, their parents or guardians—to complete surveys or questionnaires about various aspects of their lives. These parent-report data can be analyzed by themselves or in combination with any collected behavioral or psychophysiological data.

One commonly used parent-report questionnaire is the Child Behavior Checklist (CBCL) (Achenbach & Rescorla, 2000). Parents complete the preschooler version of this questionnaire by answering questions about child strengths, behavior problems, and disabilities, among other things. The responses provided by parents are used to identify whether the child has any behavioral issues, such as sleep difficulties, aggressive behaviors, depression, or attention deficit/hyperactivity problems.

A recent study used the CBCL-Preschool questionnaire (Achenbach & Rescorla, 2000) to examine preschooler functioning in relation to levels of stress experienced by their mothers while they were pregnant (Ronald et al., 2011). Almost 3,000 pregnant women were recruited into the study during their pregnancy and were interviewed about their stressful life experiences. Later, when their children were 2 years old, mothers completed the CBCL-Preschool questionnaire. The results of the study showed that higher levels of maternal stress during pregnancy (such as a divorce or moving to a new house) were associated with increased attention deficit/hyperactivity problems in children over 2 years later. These findings suggest that stressful events experienced during prenatal development may be associated with problematic child behavioral functioning years later—although additional research is needed.

Interview Techniques

Whereas infants and very young children are unable to talk about their own thoughts and behaviors, older children and adults are commonly asked to use language to discuss their thoughts and knowledge about the world. In fact, these **verbal report paradigms** are among the most widely used in psychological research. For instance, a researcher might present a child with a **vignette** or short story describing a moral dilemma, and the child would be asked to give their own thoughts and beliefs (Walrath, 2011). For example, children might react to the following:

> Mr. Kohut's wife is sick and only one medication can save her life. The medicine is extremely expensive and Mr. Kohut cannot afford it. The druggist will not lower the price. What should Mr. Kohut do, and why?

Children can provide written or verbal answers to these types of scenarios. They can also offer their perspectives on issues ranging from attitudes toward drug use to the experience of fear while falling asleep to their memories of getting lost in public places—the possibilities are endless. Verbal reports such as interviews and surveys allow children to describe their own experience of the world.

RESEARCH DESIGN

Now you know about some tools used to conduct research with infants and young children. Remember, **research methods** are the tools that are used to collect information. But it is easy to confuse research methods and research design. **Research design** is the strategy or blueprint for deciding how to collect and analyze information. Research design dictates which methods are used and how.

Researchers typically focus on two distinct types of comparisons when conducting research with infants and children. The first kind of comparison examines *change within individuals*. As the name suggests, this type of analysis measures the ways in which a specific person changes (or remains the same) over time. For example, a developmental scientist might be interested in studying the same group of infants at 12 months, 18 months, and 24 months to examine how vocabulary and grammar change over time. This kind of question would be best answered using a longitudinal research design. Another sort of comparison focuses on *changes between groups*. In this type of analysis, researchers study average changes in behavior between groups of different ages. Returning to the language example, a scientist might study the vocabulary and grammar used by 12-month-olds, 18-month-olds, and 24-month-olds to examine how language abilities change with age. This kind

of question would be best answered using a cross-sectional research design.

Longitudinal Research Designs

Longitudinal research designs are used to examine behavior in the same infants and children over time. For example, when considering our example of hide-and-seek behaviors in preschoolers, a researcher might conduct a longitudinal study to examine whether 2-year-olds develop into better hiders over time. To this end, a researcher might observe a group of 2-year-old children playing hide-and-seek with plans to observe them again when they are 4 years old—and again when they are 6 years old. This study is longitudinal in nature because the researcher plans to study the same children as they age. Based on her data, the researcher might conclude that 2-year-olds develop more mature hiding abilities with age. Remember, researchers examine games such as hide-and-seek not because they are interested in the games themselves, but because they offer clues to how children think, feel, and behave at various ages.

Longitudinal studies may be conducted over the short term (over a span of months, as in Wiebe et al., 2010) or over much longer durations (years or decades, as in Lukowski et al., 2010). For these reasons, longitudinal research designs are optimal for studying stability and change over time. Longitudinal research also has limitations, however. For one, longitudinal studies are expensive: they require that researchers maintain continued contact with participants over time, and they necessitate that scientists have funding to conduct their work over extended durations (from infancy to when participants were 19 years old in Lukowski et al., 2010). An additional risk is attrition. **Attrition** occurs when participants fail to complete all portions of a study. Participants may move, change their phone numbers, or simply become disinterested in participating over time. Researchers should account for the possibility of attrition by enrolling a larger sample into their study initially, as some participants will likely drop out over time.

The results from longitudinal studies may also be impacted by repeated assessments. Consider how well you would do on a math test if you were given the exact same exam every day for a week. Your performance would likely improve over time—not necessarily because you developed better math abilities, but because you were continuously practicing the same math problems. This phenomenon is known as a practice effect. **Practice effects** occur when participants become better at a task over time because they have done it again and again; not due to natural psychological development. A final limitation of longitudinal research is that the results may be impacted by cohort effects. **Cohort effects** occur when the results of the study are affected by the particular point in historical time during which participants are tested. As an example, think about how peer relationships in childhood have likely changed since February 2004—the month and year Facebook was founded. Cohort effects can be problematic in longitudinal research because only one group of participants are tested at one point in time—different findings might be expected if participants of the same ages were tested at different points in historical time.

Example of longitudinal research design. [This work, "Longitudinal Research Design," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Example of longitudinal research design" by Angela Lukowski and Helen Milojevich/Noba, which is licensed under CC BY-NC-SA 4.0.]

Cross-Sectional Designs

Cross-sectional research designs are used to examine behavior in participants of different ages who are tested at the same point in time. When considering our example of hide-and-seek behaviors in children, for example, a researcher might want to examine whether older children more often hide in novel locations (those in which another child in the same game has never hidden before) when compared to younger children. In this case, the researcher might observe 2-, 4-, and 6-year-old children as they play the game (the various age groups represent the "cross sections"). This research is cross-sectional in nature because the researcher plans to examine the behavior of children of different ages within the same study at the same time. Based on her data, the researcher might conclude that 2-year-olds more commonly hide in previously searched locations relative to 6-year-olds.

Cross-sectional designs are useful for many reasons. Because participants of different ages are tested at the same point in time, data collection can proceed at a rapid pace. In addition, because participants are only tested at one point in time, practice effects are not an issue—children do not have the opportunity to become better at the task over time. Cross-sectional designs are also more cost-effective than longitudinal

Year of Study: 2004	
Cohort A	2-year-olds
Cohort B	6-year-olds
Cohort C	8-year-olds

Example of cross-sectional research design. [This work, "Cross-Sectional Research Design," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Example of cross-sectional research design" by Angela Lukowski and Helen Milojevich/Noba, which is licensed under CC BY-NC-SA 4.0.]

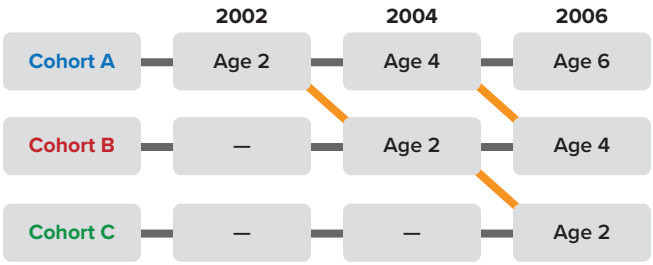
research designs because there is no need to maintain contact with and follow-up on participants over time.

One of the primary limitations of cross-sectional research, however, is that the results yield information on *age-related change, not development per se*. That is, although the study described above can show that 6-year-olds are more advanced in their hiding behavior than 2-year-olds, the data used to come up with this conclusion were collected from different children. It could be, for instance, that this specific sample of 6-year-olds just happened to be particularly clever at hide-and-seek. As such, the researcher cannot conclude that 2-year-olds develop into better hiders with age; she can only state that 6-year-olds, on average, are more sophisticated hiders relative to children 4 years younger.

Sequential Research Designs

Sequential research designs include elements of both longitudinal and cross-sectional research designs. Similar to longitudinal designs, sequential research features participants who are followed over time; similar to cross-sectional designs, sequential work includes participants of different ages. This research design is also distinct from those that have been discussed previously in that children of different ages are enrolled into a study at various points in time to examine age-related changes, assess development within the same individuals as they age, and account for the possibility of cohort effects.

Consider, once again, our example of hide-and-seek behaviors. In a study with a sequential design, a researcher might enroll three separate groups of children (Groups A, B, and C). Children in Group A would be enrolled when they are 2 years old and would be tested again when they are 4 and 6 years old (similar in design to the longitudinal study described previously). Children in Group B would be enrolled when they are 4 years old and would be tested again when they are 6 and 8 years old. Finally, children in Group C would be enrolled when they are 6 years old and would be tested again when they are 8 and 10 years old.



Example of sequential research design. [This work, "Sequential Research Design," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Example of sequential research design" by Angela Lukowski and Helen Milojevich/Noba, which is licensed under CC BY-NC-SA 4.0.]

Studies with sequential designs are powerful because they allow for both longitudinal and cross-sectional comparisons. This research design also allows for the examination of cohort effects. For example, the researcher could examine the hide-and-seek behavior of 6-year-olds in Groups A, B, and C to determine whether performance differed by group when participants were the same age. If performance differences were found, there would be evidence for a cohort effect. In the hide-and-seek example, this might mean that children from different time periods varied in the amount they giggled or how patient they are when waiting to be found. Sequential designs are also appealing because they allow researchers to learn a lot about development in a relatively short amount of time. In the previous example, a 4-year research study would provide information about 8 years of developmental time by enrolling children ranging in age from 2 to 10 years old.

Because they include elements of longitudinal and cross-sectional designs, sequential research has many of the same strengths and limitations as these other approaches. For example, sequential work may require less time and effort

TABLE 30.1. Advantages and Disadvantages of Different Research Designs

Research Design	Advantages	Disadvantages
Longitudinal	• Examines changes within individuals over time • Provides a developmental analysis	• Expensive • Takes a long time • Participant attrition • Possibility of practice effects • Cannot examine cohort effects
Cross-sectional	• Examines changes between participants of different ages at the same point in time • Provides information on age-related change	• Cannot examine change over time • Cannot examine cohort effects
Sequential	• Examines changes within individuals over time • Examines changes between participants of different ages at the same point in time • Can be used to examine cohort effects	• May be expensive • Possibility of practice effects

than longitudinal research, but more time and effort than cross-sectional research. Although practice effects may be an issue if participants are asked to complete the same tasks or assessments over time, attrition may be less problematic than what is commonly experienced in longitudinal research since participants may not have to remain involved in the study for such a long period of time.

When considering the best research design to use in their research, scientists think about their main research question and the best way to come up with an answer. A table of advantages and disadvantages for each of the described research designs is provided here to help you as you consider what sorts of studies would be best conducted using each of these different approaches (TABLE 30.1).

CHALLENGES ASSOCIATED WITH CONDUCTING DEVELOPMENTAL RESEARCH

The previous sections describe research tools to assess development in infancy and early childhood, as well as the ways that research designs can be used to track age-related changes and development over time. Before you begin conducting developmental research, however, you must also be aware that testing infants and children comes with its own unique set of challenges. In the final section of this module, we review some of the main issues that are encountered when conducting research with the youngest of human participants. In particular, we focus our discussion on ethical concerns, recruitment issues, and participant attrition.

Ethical Concerns

As a student of psychological science, you may already know that **Institutional Review Boards (IRBs)** review and approve of all research projects that are conducted at universities, hospitals, and other institutions. An IRB is typically a panel of experts who read and evaluate proposals for research. IRB members want to ensure that the proposed research will be carried out ethically and that the potential benefits of the research outweigh the risks and harm for participants. What you may not know though, is that the IRB considers some groups of participants to be more vulnerable or at-risk than others. Whereas university students are generally not viewed as vulnerable or at-risk, infants and young children commonly fall into this category. What makes infants and young children more vulnerable during research than young adults? One reason infants and young children are perceived as being at increased risk is due to their limited cognitive capabilities, which makes them unable to state their willingness to participate in research or tell researchers when they would like to drop out of a study. For these reasons, infants and young children require special accommodations as they participate in the research process.

When thinking about special accommodations in developmental research, consider the **informed consent** process. If you have ever participated in psychological research, you may know through your own experience that adults commonly sign an informed consent statement (a contract stating that they agree to participate in research) after learning about a study. As part of this process, participants are informed of the procedures to be used in the research, along with any expected risks or benefits. Infants and young children cannot verbally indicate their willingness to participate, much less understand the balance of potential risks and benefits. As such, researchers are oftentimes required to obtain written informed consent from the parent or legal guardian of the child participant, an adult who is almost always present as the study is conducted. In fact, children are not asked to indicate whether they would like to be involved in a study at all (a process known as **assent**) until they are approximately seven years old. Because infants and young children also cannot easily indicate if they would like to discontinue their participation in a study, researchers must be sensitive to changes in the state of the participant (determining whether a child is too tired or upset to continue) as well as to parent desires (in some cases, parents might want to discontinue their involvement in the research). As in adult studies, researchers must always strive to protect the rights and well-being of the minor participants and their parents when conducting developmental science.

Recruitment

An additional challenge in developmental science is participant recruitment. Recruiting university students to participate in adult studies is typically easy. Many colleges and universities offer extra credit for participation in research and have locations such as bulletin boards and school newspapers where research can be advertised. Unfortunately, young children cannot be recruited by making announcements in Introduction to Psychology courses, by posting ads on campuses, or through online platforms such as Amazon Mechanical Turk. Given these limitations, how do researchers go about finding infants and young children to be in their studies?

The answer to this question varies along multiple dimensions. Researchers must consider the number of participants they need and the financial resources available to them, among other things. Location may also be an important consideration. Researchers who need large numbers of infants and children may attempt to do so by obtaining infant birth records from the state, county, or province in which they reside. Some areas make this information publicly available for free, whereas birth records must be purchased in other areas (and in some locations birth records may be entirely unavailable as a recruitment tool). If birth records are

Participating in developmental research can sometimes be difficult for both children and their parents. This can contribute to a higher attrition rate than is typical in other types of research. ["mother carrying baby" by Tina Franklin/Flickr is licensed under CC BY 2.0.]

available, researchers can use the obtained information to call families by phone or mail them letters describing possible research opportunities. All is not lost if this recruitment strategy is unavailable, however. Researchers can choose to pay a recruitment agency to contact and recruit families for them. Although these methods tend to be quick and effective, they can also be quite expensive. More economical recruitment options include posting advertisements and fliers in locations frequented by families, such as mommy-and-me classes, local malls, and preschools or day care centers. Researchers can also utilize online social media outlets like Facebook, which allows users to post recruitment advertisements for a small fee. Of course, each of these different recruitment techniques requires IRB approval.

Attrition

Another important consideration when conducting research with infants and young children is attrition. Although attrition is quite common in longitudinal research in particular, it is also problematic in developmental science more generally, as studies with infants and young children tend to have higher attrition rates than studies with adults. For example, high attrition rates in ERP studies oftentimes result from the demands of the task: infants are required to sit still and have a tight, wet cap placed on their heads before watching still photographs on a computer screen in a dark, quiet room. In other cases, attrition may be due to motivation (or a lack thereof). Whereas adults may be motivated to participate in research in order to receive money or extra course credit, infants and young children are not as easily enticed. In addition, infants and young children are more likely to tire easily, become fussy, and lose interest in the study procedures than are adults. For these reasons, research studies should be designed to be as short as possible—it is likely better to break up a large study into multiple short sessions rather than cram all of the tasks into one long visit to the lab. Researchers should also allow time for breaks in their study protocols so that infants can rest or have snacks as needed. Happy, comfortable participants provide the best data.

CONCLUSION

Child development is a fascinating field of study—but care must be taken to ensure that researchers use appropriate methods to examine infant and child behavior, use the correct experimental design to answer their questions, and be aware of the special challenges that are part-and-parcel of developmental research. After reading this module, you should have a solid understanding of these various issues and be ready to think more critically about research questions that interest you. For example, when considering our initial example of hide-and-seek behaviors in preschoolers, you might ask questions about what other factors might contribute to hiding behaviors in children. Do children with older siblings hide in locations that were previously searched less often than children without siblings? What other abilities are associated with the development of hiding skills? Do children who use more sophisticated hiding strategies as preschoolers do better on other tests of cognitive functioning in high school? Many interesting questions remain to be examined by future generations of developmental scientists—maybe you will make one of the next big discoveries!

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READING 31

Personality Traits

Edward Diener and Richard E. Lucas

SOURCE

Diener, E., & Lucas, R. E. (2020). Personality traits. In R. Biswas-Diener & E. Diener (Eds.), *Noba textbook series: Psychology.* DEF Publishers. http://noba.to/96u8ecgw

LEARNING OBJECTIVES

- List and describe the "Big Five" ("OCEAN") personality traits that comprise the Five-Factor Model of personality.
- Describe how the facet approach extends broad personality traits.
- Explain a critique of the personality-trait concept.
- Describe in what ways personality traits may be manifested in everyday behavior.
- Describe and give examples of the low and high end of each of the Big Five personality traits.
- Describe how traits and social learning combine to predict your social activities.
- Describe your theory of how personality traits get refined by social learning.

KEY TERMS

agreeableness
conscientiousness
continuous distributions
extraversion
facets
factor analysis
Five-Factor Model
HEXACO model
lexical hypothesis
neuroticism
openness
personality
personality traits
person-situation debate

Personality traits reflect people's characteristic patterns of thoughts, feelings, and behaviors. Personality traits imply consistency and stability—someone who scores high on a specific trait like Extraversion is expected to be sociable in different situations and over time. Thus, trait psychology rests on the idea that people differ from one another in terms of where they stand on a set of basic trait dimensions that persist over time and across situations. The most widely used system of traits is called the Five-Factor Model. This system includes five broad traits that can be remembered with the acronym OCEAN: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Each of the major traits from the Big Five can be divided into facets to give a more fine-grained analysis of someone's personality. In addition, some trait theorists argue that there are other traits that cannot be completely captured by the Five-Factor Model. Critics of the trait concept argue that people do not act consistently from one situation to the next and that people are very influenced by situational forces. Thus, one major debate in the field concerns the relative power of people's traits versus the situations in which they find themselves as predictors of their behavior.

INTRODUCTION

When we observe people around us, one of the first things that strikes us is how different people are from one another. Some people are very talkative, wheras others are very quiet. Some are active, whereas others are couch potatoes. Some worry a lot, others almost never seem anxious. Each time we use one of these words—words like "talkative," "quiet," "active," or "anxious"—to describe those around us, we are talking about a person's **personality**: the characteristic ways that people differ from one another. Personality psychologists try to describe and understand these differences.

Although there are many ways to think about the personalities that people have, Gordon Allport and other "personologists" claimed that we can best understand the differences between individuals by understanding their personality traits. **Personality traits** reflect basic dimensions on which people differ (Matthews et al., 2003). According to trait psychologists, there are a limited number of these dimensions (such as Extraversion, Conscientiousness, or Agreeableness), and each individual falls somewhere on each dimension, meaning that they could be low, medium, or high on any specific trait.

An important feature of personality traits is that they reflect **continuous distributions** rather than distinct personality types. This means that when personality psychologists talk about Introverts and Extraverts, they are not really talking about two distinct types of people who are completely and qualitatively different from one another.

"Are you an introvert"? In popular culture it's common to talk about people being introverts or extraverts, as if these were precise descriptions that meant the same thing for everyone. But research shows that these traits and others are quite variable within individuals. ["Fwd: How Not To Manage An Introvert?" by Nguyen Hung Vu is licensed under CC BY 2.0.]

Instead, they are talking about people who score relatively low or relatively high along a continuous distribution. In fact, when personality psychologists measure traits like Extraversion, they typically find that most people score somewhere in the middle, with smaller numbers showing more extreme levels. **FIGURE 31.1** shows the distribution of Extraversion scores from a survey of thousands of people. As you can see, most people report being moderately, but not extremely, extraverted, with fewer people reporting very high or very low scores.

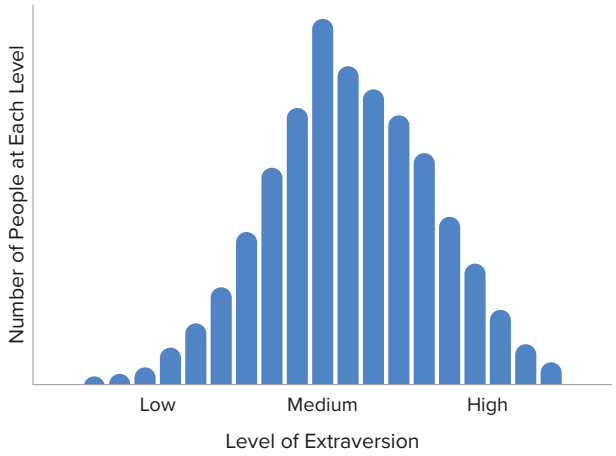

FIGURE 31.1. Distribution of extraversion scores in a sample. Higher bars mean that more people have scores of that level. This figure shows that most people score toward the middle of the extraversion scale, with fewer people who are highly extraverted or highly introverted. [This work, "Level of Extraversion," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Figure 1" by Edward Diener and Richard E. Lucas/Noba, which is licensed under CC BY-NC-SA 4.0.]

There are three criteria that characterize personality traits: (1) consistency, (2) stability, and (3) individual differences.

1. To have a personality trait, individuals must be somewhat consistent across situations in their behaviors related to the trait. For example, if they are talkative at home, they tend also to be talkative at work.
2. Individuals with a trait are also somewhat stable over time in behaviors related to the trait. If they are talkative, for example, at age 30, they will also tend to be talkative at age 40.
3. People differ from one another on behaviors related to the trait. Using speech is not a personality trait and neither is walking on two feet—virtually all individuals do these activities, and there are almost no individual differences. But people differ on how frequently they talk and how active they are, and thus personality traits such as Talkativeness and Activity Level do exist.

A challenge of the trait approach was to discover the major traits on which all people differ. Scientists for many decades generated hundreds of new traits, so that it was soon difficult to keep track and make sense of them. For instance, one psychologist might focus on individual differences in "friendliness," whereas another might focus on the highly related concept of "sociability." Scientists began seeking ways to reduce the number of traits in some systematic way and to discover the basic traits that describe most of the differences between people.

The way that Gordon Allport and his colleague Henry Odbert approached this was to search the dictionary for all descriptors of personality (Allport & Odbert, 1936). Their approach was guided by the **lexical hypothesis**, which states that all important personality characteristics should be reflected in the language that we use to describe other people. Therefore, if we want to understand the fundamental ways in which people differ from one another, we can turn to the words that people use to describe one another. So if we want to know what words people use to describe one another, where should we look? Allport and Odbert looked in the most obvious place—the dictionary. Specifically, they took all the personality descriptors that they could find in the dictionary (they started with almost 18,000 words but quickly reduced that list to a more manageable number) and then used statistical techniques to determine which words "went together." In other words, if everyone who said that they were "friendly" also said that they were "sociable," then this might mean that personality psychologists would only need a single trait to capture individual differences in these characteristics. Statistical techniques were used to determine whether a small number of dimensions might underlie all of the thousands of words we use to describe people.

THE FIVE-FACTOR MODEL OF PERSONALITY

Research that used the lexical approach showed that many of the personality descriptors found in the dictionary do indeed overlap. In other words, many of the words that we use to describe people are synonyms. Thus, if we want to know what a person is like, we do not necessarily need to ask how sociable they are, how friendly they are, and how gregarious they are. Instead, because sociable people tend to be friendly and gregarious, we can summarize this personality dimension with a single term. Someone who is sociable, friendly, and gregarious would typically be described as an "Extravert." Once we know she is an extravert, we can assume that she is sociable, friendly, and gregarious.

Statistical methods (specifically, a technique called **factor analysis**) helped to determine whether a small number of dimensions underlie the diversity of words that people like Allport and Odbert identified. The most widely accepted system to emerge from this approach was "The Big Five" or "**Five-Factor Model**" (Goldberg, 1990; McCrae & Costa, 1987; McCrae & John, 1992). The Big Five comprises five major traits shown in TABLE 31.1. A way to remember these five is with the acronym OCEAN (O is for **Openness**; C is for **Conscientiousness**; E is for **Extraversion**; A is for **Agreeableness**; N is for **Neuroticism**). TABLE 31.2 provides descriptions of people who would score high and low on each of these traits.

Scores on the Big Five traits are mostly independent. That means that a person's standing on one trait tells very little about their standing on the other traits of the Big Five. For example, a person can be extremely high in Extraversion and be either high or low on Neuroticism. Similarly, a person can be low in Agreeableness and be either high or low in Conscientiousness. Thus, in the Five-Factor Model, you need five scores to describe most of an individual's personality.

In the Appendix to this reading, we present a short scale to assess the Five-Factor Model of personality (Donnellan et al., 2006). You can take this test to see where you stand in terms of your Big Five scores. John Johnson has also created a helpful website that has personality scales that can be used and taken by the general public:

http://www.personal.psu.edu/j5j/IPIP/ipipneo120.htm

After seeing your scores, you can judge for yourself whether you think such tests are valid.

Traits are important and interesting because they describe stable patterns of behavior that persist for long periods of time (Caspi et al., 2005). Importantly, these stable patterns can have broad-ranging consequences for many areas of our life (Roberts et al., 2007). For instance, think about the factors that determine success in college. If you were asked to guess what factors predict good grades in college, you might guess something like intelligence. This guess would be correct, but we know much more about who is likely to do well. Specifically, personality researchers have also found that

TABLE 31.1. Descriptions of the Big Five Personality Traits

Big Five Trait	Definition
Openness	The tendency to appreciate new art, ideas, values, feelings, and behaviors
Conscientiousness	The tendency to be careful, to be on-time for appointments, to follow rules, and to be hardworking
Extraversion	The tendency to be talkative, to be sociable, and to enjoy others; the tendency to have a dominant style
Agreeableness	The tendency to agree and go along with others rather than to assert one's own opinions and choices
Neuroticism	The tendency to frequently experience negative emotions such as anger, worry, and sadness; the tendency to be interpersonally sensitive

TABLE 31.2. Example Behaviors for Those Scoring Low and High for the Big Five Traits

Big Five Trait	Example Behavior for LOW Scorers	Example Behavior for HIGH Scorers
Openness	Prefers not to be exposed to alternative moral systems; narrow interests; inartistic; not analytical; down-to-earth	Enjoys seeing people with new types of haircuts and body piercing; curious; imaginative; untraditional
Conscientiousness	Prefers spur-of-the-moment action to planning; unreliable; hedonistic; careless; lax	Never late for a date; organized; hardworking; neat; persevering; punctual; self-disciplined
Extraversion	Prefers a quiet evening reading to a loud party; sober; aloof; unenthusiastic	Is the life of the party; active; optimistic; fun-loving; affectionate
Agreeableness	Quickly and confidently asserts own rights; irritable; manipulative; uncooperative; rude	Agrees with others about political opinions; good-natured; forgiving; gullible; helpful
Neuroticism	Not irritated by small annoyances; calm; unemotional; hardy; secure; self-satisfied	Constantly worries about little things; insecure; hypochondriacal; feels inadequate

personality traits like Conscientiousness play an important role in college and beyond, probably because highly conscientious individuals study hard, get their work done on time, and are less distracted by nonessential activities that take time away from school work. In addition, highly conscientious people are often healthier than people low in conscientiousness because they are more likely to maintain healthy diets, to exercise, and to follow basic safety procedures like wearing seat belts or bicycle helmets. Over the long term, this consistent pattern of behaviors can add up to meaningful differences in health and longevity. Thus, personality traits are not just a useful way to describe people you know; they actually help psychologists predict how good a worker someone will be, how long he or she will live, and the types of jobs and activities the person will enjoy. Thus, there is growing interest in personality psychology among psychologists who work in applied settings, such as health psychology or organizational psychology.

FACETS OF TRAITS (SUBTRAITS)

So how does it feel to be told that your entire personality can be summarized with scores on just five personality traits? Do you think these five scores capture the complexity of your own and others' characteristic patterns of thoughts, feelings, and behaviors? Most people would probably say no, pointing to some exception in their behavior that goes against the general pattern that others might see. For instance, you may know people who are warm and friendly and find it easy to talk with strangers at a party yet are terrified if they have to perform in front of others or speak to large groups of people. The fact that there are different ways of being extraverted or conscientious shows that there is value in considering lower-level units of personality that are more specific than the Big Five traits. These more specific, lower-level units of personality are often called **facets**.

To give you a sense of what these narrow units are like, TABLE 31.3 shows facets for each of the Big Five traits. It is important to note that although personality researchers generally agree about the value of the Big Five traits as a way to summarize one's personality, there is no widely accepted list of facets that should be studied. The list seen here, based on work by researchers Paul Costa and Jeff McCrae, thus reflects just one possible list among many. It should, however, give you an idea of some of the facets making up each of the Five-Factor Model.

Facets can be useful because they provide more specific descriptions of what a person is like. For instance, if we take our friend who loves parties but hates public speaking, we might say that this person scores high on the "gregariousness" and "warmth" facets of extraversion, while scoring lower on facets such as "assertiveness" or "excitement-seeking."

TABLE 31.3. Facets of Big Five Personality Traits

Trait	Facets of Trait
Openness	• Fantasy prone • Open to feelings • Open to diverse behaviors • Open to new and different ideas • Open to various values and beliefs
Conscientiousness	• Competent • Orderly • Dutiful • Achievement oriented • Self-disciplined • Deliberate
Extraversion	• Gregarious (sociable) • Warm • Assertive • Active • Excitement-seeking • Positive emotionality
Agreeableness	• Trusting • Straightforward • Altruistic • Compliant • Modest • Tender-minded
Neuroticism	• Anxious • Angry • Depressed • Self-conscious • Impulsive • Vulnerable

This precise profile of facet scores not only provides a better description, it might also allow us to better predict how this friend will do in a variety of different jobs (for example, jobs that require public speaking versus jobs that involve one-on-one interactions with customers) (Paunonen & Ashton, 2001). Because different facets within a broad, global trait like extraversion tend to go together (those who are gregarious are often but not always assertive), the broad trait often provides a useful summary of what a person is like. But when we really want to know a person, facet scores add to our knowledge in important ways.

OTHER TRAITS BEYOND THE FIVE-FACTOR MODEL

Despite the popularity of the Five-Factor Model, it is certainly not the only model that exists. Some suggest that there are more than five major traits, or perhaps even fewer. For example, in one of the first comprehensive models to be proposed, Hans Eysenck suggested that Extraversion and Neuroticism are most important. Eysenck believed that by

TABLE 31.4. Other Traits Beyond Those Included in the Big Five

Personality Trait	Description
Machiavellianism	Named after the famous political philosopher, Niccolo Machiavelli, this trait refers to individuals who manipulate the behavior of others, often through duplicity. Machiavellians are often interested in money and power, and pragmatically use others in this quest.
Need for Achievement	Those high in need for achievement want to accomplish a lot and set high standards of excellence for themselves. They are able to work persistently and hard for distant goals. David McClelland argued that economic growth depends in part on citizens with high need for achievement.
Need for Cognition	People high in need for cognition find it rewarding to understand things and are willing to use considerable cognitive effort in this quest. Such individuals enjoy learning and the process of trying to understand new things.
Authoritarianism	Authoritarians believe in strict social hierarchies in which they are totally obedient to those above them and expect complete obedience from their subordinates. Rigid in adherence to rules, the authoritarian personality is very uncomfortable with uncertainty.
Narcissism	The narcissistic personality has self-love that is so strong that it results in high levels of vanity, conceit, and selfishness. The narcissistic individual often has problems feeling empathetic toward others and grateful to others.
Self-esteem	The tendency to evaluate oneself positively. Self-esteem does not imply that one believes that he or she is better than others, only that he or she is a person of worth.
Optimism	The tendency to expect positive outcomes in the future. People who are optimistic expect good things to happen, and indeed they often have more positive outcomes, perhaps because they work harder to achieve them.
Alexithymia	The inability to recognize and label emotions in oneself. The individual also has a difficult time recognizing emotions in others and often has difficulties in relationships.

combining people's standing on these two major traits, we could account for many of the differences in personality that we see in people (Eysenck, 1981). So for instance, a neurotic introvert would be shy and nervous, while a stable introvert might avoid social situations and prefer solitary activities, but he may do so with a calm, steady attitude and little anxiety or emotion. Interestingly, Eysenck attempted to link these two major dimensions to underlying differences in people's biology. For instance, he suggested that introverts experienced too much sensory stimulation and arousal, which made them want to seek out quiet settings and less stimulating environments. More recently, Jeffrey Gray (1981) suggested that these two broad traits are related to fundamental reward and avoidance systems in the brain—extraverts might be motivated to seek reward and thus exhibit assertive, reward-seeking behavior, whereas people high in neuroticism might be motivated to avoid punishment and thus may experience anxiety as a result of their heightened awareness of the threats in the world around them (Gray's model has since been updated; see Gray & McNaughton, 2000). These early theories have led to a burgeoning interest in identifying the physiological underpinnings of the individual differences that we observe.

Another revision of the Big Five is the **HEXACO model** of traits (Ashton & Lee, 2007). This model is similar to the Big Five, but it posits slightly different versions of some of the traits, and its proponents argue that one important class of individual differences was omitted from the Five-Factor Model. The HEXACO adds Honesty-Humility as a sixth dimension of personality. People high in this trait are sincere, fair, and modest, whereas those low in the trait are manipulative, narcissistic, and self-centered. Thus, trait theorists are agreed that personality traits are important in understanding behavior, but there are still debates on the exact number and composition of the traits that are most important.

There are other important traits that are not included in comprehensive models like the Big Five. Although the five factors capture much that is important about personality, researchers have suggested other traits that capture interesting aspects of our behavior. In TABLE 31.4 we present just a few, out of hundreds, of the other traits that have been studied by personologists.

Not all of the traits in TABLE 31.4 are currently popular with scientists, yet each of them has experienced popularity in the past. Although the Five-Factor Model has been the target of more rigorous research than some of the traits in the table, these additional personality characteristics give a good idea of the wide range of behaviors and attitudes that traits can cover.

THE PERSON-SITUATION DEBATE AND ALTERNATIVES TO THE TRAIT PERSPECTIVE

The ideas described in this module should probably seem familiar, if not obvious to you. When asked to think about what our friends, enemies, family members, and colleagues

are like, some of the first things that come to mind are their personality characteristics. We might think about how warm and helpful our first teacher was, how irresponsible and careless our brother is, or how demanding and insulting our first boss was. Each of these descriptors reflects a personality trait, and most of us generally think that the descriptions we use for individuals accurately reflect their "characteristic pattern of thoughts, feelings, and behaviors," or in other words, their personality.

But what if this idea were wrong? What if our belief in personality traits were an illusion and people are not consistent from one situation to the next? This was a possibility that shook the foundation of personality psychology in the late 1960s when Walter Mischel published a book called *Personality and Assessment* (1968). In this book, Mischel suggested that if one looks closely at people's behavior across many different situations, the consistency is really not that impressive. In other words, children who cheat on tests at school may steadfastly follow all rules when playing games and may never tell a lie to their parents. In other words, he suggested, there may not be any general trait of honesty that links these seemingly related behaviors. Furthermore, Mischel suggested that observers may believe that broad personality traits like honesty exist when, in fact, this belief is an illusion. The debate that followed the publication of Mischel's book was called the **person-situation debate** because it pitted the power of personality against the power of situational factors as determinants of the behavior that people exhibit.

Because of the findings that Mischel emphasized, many psychologists focused on an alternative to the trait perspective.

The way people behave is only in part a product of their natural personality. Situations also influence how a person behaves. Are you for instance a "different person" as a student in a classroom compared to when you're a member of a close-knit social group? ["2013 09 26 COE orientation 679" by uoeducation/Flickr is licensed under CC BY-NC 2.0.]

Instead of studying broad, context-free descriptions, like the trait terms we've described so far, Mischel thought that psychologists should focus on people's distinctive reactions to specific situations. For instance, although there may not be a broad and general trait of honesty, some children may be especially likely to cheat on a test when the risk of being caught is low and the rewards for cheating are high. Others might be motivated by the sense of risk involved in cheating and may do so even when the rewards are not very high. Thus, the behavior itself results from the child's unique evaluation of the risks and rewards present at that moment, along with her evaluation of her abilities and values. Because of this, the same child might act very differently in different situations. Thus, Mischel thought that specific behaviors were driven by the interaction between very specific, psychologically meaningful features of the situation in which people found themselves, the person's unique way of perceiving that situation, and his or her abilities for dealing with it. Mischel and others argued that it was these social-cognitive processes that underlie people's reactions to specific situations that provide some consistency when situational features are the same. If so, then studying these broad traits might be more fruitful than cataloging and measuring narrow, context-free traits like Extraversion or Neuroticism.

In the years after the publication of Mischel's (1968) book, debates raged about whether personality truly exists, and if so, how it should be studied. And, as is often the case, it turns out that a more moderate middle ground than what the situationists proposed could be reached. It is certainly true, as Mischel pointed out, that a person's behavior in one specific situation is not a good guide to how that person will behave in a very different specific situation. Someone who is extremely talkative at one specific party may sometimes be reticent to speak up during class and may even act like a wallflower at a different party. But this does not mean that personality does not exist, nor does it mean that people's behavior is completely determined by situational factors. Indeed, research conducted after the person-situation debate shows that on average, the effect of the "situation" is about as large as that of personality traits. However, it is also true that if psychologists assess a broad range of behaviors across many different situations, there are general tendencies that emerge. Personality traits give an indication about how people will act on average, but frequently they are not so good at predicting how a person will act in a specific situation at a certain moment in time. Thus, to best capture broad traits, one must assess *aggregate* behaviors, averaged over time and across many different types of situations. Most modern personality researchers agree that there is a place for broad personality traits and for the narrower units such as those studied by Walter Mischel.

APPENDIX

The Mini-IPIP Scale

(Donnellan et al., 2006)

Instructions: Below are phrases describing people's behaviors. Please use the rating scale below to describe how accurately each statement describes you. Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. Please read each statement carefully, and put a number from 1 to 5 next to it to describe how accurately the statement describes you.

1 = Very inaccurate
2 = Moderately inaccurate
3 = Neither inaccurate nor accurate
4 = Moderately accurate
5 = Very accurate

1. _____ Am the life of the party (E)
2. _____ Sympathize with others' feelings (A)
3. _____ Get chores done right away (C)
4. _____ Have frequent mood swings (N)
5. _____ Have a vivid imagination (O)
6. _____ Don't talk a lot (E)
7. _____ Am not interested in other people's problems (A)
8. _____ Often forget to put things back in their proper place (C)
9. _____ Am relaxed most of the time (N)
10. _____ Am not interested in abstract ideas (O)
11. _____ Talk to a lot of different people at parties (E)
12. _____ Feel others' emotions (A)
13. _____ Like order (C)
14. _____ Get upset easily (N)
15. _____ Have difficulty understanding abstract ideas (O)
16. _____ Keep in the background (E)
17. _____ Am not really interested in others (A)
18. _____ Make a mess of things (C)
19. _____ Seldom feel blue (N)
20. _____ Do not have a good imagination (O)

Scoring: The first thing you must do is to reverse the items that are worded in the opposite direction. In order to do this, subtract the number you put for that item from 6. So if you put a 4, for instance, it will become a 2. Cross out the score you put when you took the scale, and put the new number in representing your score subtracted from the number 6.

Items to be reversed in this way:
6, 7, 8, 9, 10, 15, 16, 17, 18, 19, 20

Next, you need to add up the scores for each of the five OCEAN scales (including the reversed numbers where relevant). Each OCEAN score will be the sum of four items. Place the sum next to each scale below.

_____ Openness: Add items 5, 10, 15, 20
_____ Conscientiousness: Add items 3, 8, 13, 18
_____ Extraversion: Add items 1, 6, 11, 16
_____ Agreeableness: Add items 2, 7, 12, 17
_____ Neuroticism: Add items 4, 9,14, 19

Compare your scores to the norms below to see where you stand on each scale. If you are low on a trait, it means you are the opposite of the trait label. For example, low on Extraversion is Introversion, low on Openness is Conventional, and low on Agreeableness is Assertive.

19–20	Extremely high
17–18	Very high
14–16	High
11–13	Neither high nor low; in the middle
8–10	Low
6–7	Very low
4–5	Extremely low

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READING 32

What Are Psychological Disorders?

SOURCE

OpenStax. (2019). *Psychology.* OpenStax CNX. https://openstax.org/details/books/psychology

LEARNING OBJECTIVES

- Understand the problems inherent in defining the concept of psychological disorder.
- Describe what is meant by harmful dysfunction.
- Identify the formal criteria that thoughts, feelings, and behaviors must meet to be considered abnormal and, thus, symptomatic of a psychological disorder.

KEY TERMS

atypical
etiology
harmful dysfunction
psychological disorder
psychopathology

A **psychological disorder** is a condition characterized by abnormal thoughts, feelings, and behaviors. **Psychopathology** is the study of psychological disorders, including their symptoms, **etiology** (i.e., their causes), and treatment. The term *psychopathology* can also refer to the manifestation of a psychological disorder. Although consensus can be difficult, it is extremely important for mental health professionals to agree on what kinds of thoughts, feelings, and behaviors are truly abnormal in the sense that they genuinely indicate the presence of psychopathology. Certain patterns of behavior and inner experience can easily be labeled as abnormal and clearly signify some kind of psychological disturbance. The person who washes his hands 40 times per day and the person who claims to hear the voices of demons exhibit behaviors and inner experiences that most would regard as abnormal: beliefs and behaviors that suggest the existence of a psychological disorder. But, consider the nervousness a young man feels when talking to attractive women or the loneliness and longing for home a freshman experiences during her first semester of college—these feelings may not be regularly present, but they fall in the range of normal. So, what kinds of thoughts, feelings, and behaviors represent a true psychological disorder? Psychologists work to distinguish psychological disorders from inner experiences and behaviors that are merely situational, idiosyncratic, or unconventional.

DEFINITION OF A PSYCHOLOGICAL DISORDER

Perhaps the simplest approach to conceptualizing psychological disorders is to label behaviors, thoughts, and inner experiences that are atypical, distressful, dysfunctional, and sometimes even dangerous, as signs of a disorder. For example, if you ask a classmate for a date and you are rejected, you probably would feel a little dejected. Such feelings would be normal. If you felt extremely depressed—so much so that you lost interest in activities, had difficulty eating or sleeping, felt utterly worthless, and contemplated suicide—your feelings would be **atypical**, would deviate from the norm, and could signify the presence of a psychological disorder. Just because something is atypical, however, does not necessarily mean it is disordered.

For example, only about 4% of people in the United States have red hair, so red hair is considered an atypical characteristic (**FIGURE 31.1**), but it is not considered disordered, it's just unusual. And it is less unusual in Scotland, where approximately 13% of the population has red hair ("DNA Project Aims," 2012). As you will learn, some disorders, although not exactly typical, are far from atypical, and the rates in which they appear in the population are surprisingly high.

(a) (b) (c)

FIGURE 31.1. Red hair is considered unusual, but not abnormal. (a) Isla Fischer, (b) Prince Harry, and (c) Jessica Chastain are three natural redheads. [(a) "Isla Fisher 2013" by Georges Biard/Wikimedia Commons is licensed under CC BY-SA 3.0; (b) "Prince Harry, Duke of Sussex 2020 cropped 02" by UK Department of International Development/ Wikimedia Commons is licensed under CC BY 2.0; (c) "Jessica Chastain Cannes 2012 (Cropped)" by Georges Biard/Wikimedia Commons is licensed under CC BY-SA 3.0.]

If we can agree that merely being atypical is an insufficient criterion for a having a psychological disorder, is it reasonable to consider behavior or inner experiences that differ from widely expected cultural values or expectations as disordered? Using this criterion, a woman who walks around a subway platform wearing a heavy winter coat in July while screaming obscenities at strangers may be considered as exhibiting symptoms of a psychological disorder. Her actions and clothes violate socially accepted rules governing appropriate dress and behavior; these characteristics are atypical.

CULTURAL EXPECTATIONS

Violating cultural expectations is not, in and of itself, a satisfactory means of identifying the presence of a psychological disorder. Since behavior varies from one culture to another, what may be expected and considered appropriate in one culture may not be viewed as such in other cultures. For example, returning a stranger's smile is expected in the United States because a pervasive social norm dictates that we reciprocate friendly gestures. A person who refuses to acknowledge such gestures might be considered socially awkward—perhaps even disordered—for violating this expectation. However, such expectations are not universally shared. Cultural expectations in Japan involve showing reserve, restraint, and a concern for maintaining privacy around strangers. Japanese people are generally unresponsive to smiles from strangers (Patterson et al., 2007). Eye contact provides another example. In the United States and Europe, eye contact with others typically signifies honesty and attention. However, most Latin American, Asian, and African cultures interpret direct eye contact as rude, confrontational, and aggressive (Pazain, 2010). Thus, someone who makes eye contact with you could be considered appropriate and respectful or brazen and offensive, depending on your culture (**FIGURE 31.2**).

FIGURE 31.2. Eye contact is one of many social gestures that vary from culture to culture. ["Mike and Mimi" by Joi Ito/Flickr is licensed under CC BY 2.0.]

Hallucinations (seeing or hearing things that are not physically present) in Western societies is a violation of cultural expectations, and a person who reports such inner experiences is readily labeled as psychologically disordered. In other cultures, visions that, for example, pertain to future events may be regarded as normal experiences that are positively valued (Bourguignon, 1970). Finally, it is important to recognize that cultural norms change over time: what might be considered typical in a society at one time may no longer be viewed this way later, similar to how fashion trends from one era may elicit quizzical looks decades later—imagine how a headband, legwarmers, and the big hair of the 1980s would go over on your campus today.

HARMFUL DYSFUNCTION

If none of the criteria discussed so far is adequate by itself to define the presence of a psychological disorder, how can a disorder be conceptualized? Many efforts have been made to identify the specific dimensions of psychological disorders, yet none is entirely satisfactory. No universal definition of psychological disorder exists that can apply to all situations in which a disorder is thought to be present (Zachar & Kendler, 2007). However, one of the more influential conceptualizations was proposed by Wakefield (1992), who defined psychological disorder as a **harmful dysfunction**. Wakefield argued that natural internal mechanisms—that is, psychological processes honed by evolution, such as cognition, perception, and learning—have important functions, such as enabling us to experience the world the way others do and to engage in rational thought, problem solving, and communication. For example, learning allows us to associate a fear with a potential danger in such a way that the intensity of fear is roughly equal to the degree of actual danger. Dysfunction occurs when an internal mechanism breaks down and can no longer perform its normal function. But the presence of a dysfunction by itself does not determine a disorder. The dysfunction must be harmful in that it leads to negative consequences for the individual or for others, as judged by the standards of the individual's culture. The harm may include significant internal anguish (e.g., high levels of anxiety or depression) or problems in day-to-day living (e.g., in one's social or work life).

To illustrate, Janet has an extreme fear of spiders. Janet's fear might be considered a dysfunction in that it signals that the internal mechanism of learning is not working correctly (i.e., a faulty process prevents Janet from appropriately associating the magnitude of her fear with the actual threat posed by spiders). Janet's fear of spiders has a significant negative influence on her life: she avoids all situations in which she suspects spiders to be present (e.g., the basement or a friend's home), and she quit her job last month and is now unemployed because she saw a spider in the restroom at work.

DIG DEEPER

The Myth of Mental Illness

In the 1950s and 1960s, the concept of mental illness was widely criticized. One of the major criticisms focused on the notion that mental illness was a "myth that justifies psychiatric intervention in socially disapproved behavior" (Wakefield, 1992). Thomas Szasz (1960), a noted psychiatrist, was perhaps the biggest proponent of this view. Szasz argued that the notion of mental illness was invented by society (and the mental health establishment) to stigmatize and subjugate people whose behavior violates accepted social and legal norms. Indeed, Szasz suggested that what appear to be symptoms of mental illness are more appropriately characterized as "problems in living" (Szasz, 1960).

In his 1961 book, *The Myth of Mental Illness: Foundations of a Theory of Personal Conduct*, Szasz expressed his disdain for the concept of mental illness and for the field of psychiatry in general (Oliver, 2006). The basis for Szasz's attack was his contention that detectable abnormalities in bodily structures and functions (e.g., infections and organ damage or dysfunction) represent the defining features of genuine illness or disease, and because symptoms of purported mental illness are not accompanied by such detectable abnormalities, so-called psychological disorders are not disorders at all. Szasz (1961/2010) proclaimed that "disease or illness can only affect the body; hence, there can be no mental illness" (p. 267).

Today, we recognize the extreme level of psychological suffering experienced by people with psychological disorders: the painful thoughts and feelings they experience, the disordered behavior they demonstrate, and the levels of distress and impairment they exhibit. This makes it very difficult to deny the reality of mental illness.

However controversial Szasz's views and those of his supporters might have been, they have influenced the mental health community and society in several ways. First, lay people, politicians, and professionals now often refer to mental illness as mental health "problems," implicitly acknowledging the "problems in living" perspective Szasz described (Buchanan-Barker & Barker, 2009). Also influential was Szasz's view of homosexuality. Szasz was perhaps the first psychiatrist to openly challenge the idea that homosexuality represented a form of mental illness or disease (Szasz, 1965). By challenging the idea that homosexuality represented a form a mental illness, Szasz helped pave the way for the social and civil rights that gay and lesbian people now have (Barker & Buchanan-Barker, 2010). His work also inspired legal changes that protect the rights of people in psychiatric institutions and allow such individuals a greater degree of influence and responsibility over their lives (Buchanan-Barker & Barker, 2009). ■

According to the harmful dysfunction model, Janet's condition would signify a disorder because (a) there is a dysfunction in an internal mechanism, and (b) the dysfunction has resulted in harmful consequences. Similar to how the symptoms of physical illness reflect dysfunctions in biological processes, the symptoms of psychological disorders presumably reflect dysfunctions in mental processes. The internal mechanism component of this model is especially appealing because it implies that disorders may occur through a breakdown of biological functions that govern various psychological processes, thus supporting contemporary neurobiological models of psychological disorders (Fabrega, 2007).

THE AMERICAN PSYCHIATRIC ASSOCIATION (APA) DEFINITION

Many of the features of the harmful dysfunction model are incorporated in a formal definition of psychological disorder developed by the American Psychiatric Association (APA). According to the APA (2013), a psychological disorder is a condition that is said to consist of the following:

- **There are significant disturbances in thoughts, feelings, and behaviors.** A person must experience inner states (e.g., thoughts and/or feelings) and exhibit behaviors that are clearly disturbed—that is, unusual, but in a negative, self-defeating way. Often, such disturbances are troubling to those around the individual who experiences them. For example, an individual who is uncontrollably preoccupied by thoughts of germs spends hours each day bathing, has inner experiences, and displays behaviors that most would consider atypical and negative (disturbed) and that would likely be troubling to family members.
- **The disturbances reflect some kind of biological, psychological, or developmental dysfunction.** Disturbed patterns of inner experiences and behaviors should reflect some flaw (dysfunction) in the internal biological, psychological, and developmental mechanisms that lead to normal, healthy psychological functioning. For example, the hallucinations observed in schizophrenia could be a sign of brain abnormalities.

- **The disturbances lead to significant distress or disability in one's life.** A person's inner experiences and behaviors are considered to reflect a psychological disorder if they cause the person considerable distress or greatly impair his ability to function as a normal individual (often referred to as functional impairment, or occupational and social impairment). As an illustration, a person's fear of social situations might be so distressing that it causes the person to avoid all social situations (e.g., preventing that person from being able to attend class or apply for a job).
- **The disturbances do not reflect expected or culturally approved responses to certain events.** Disturbances in thoughts, feelings, and behaviors must be socially unacceptable responses to certain events that often happen in life. For example, it is perfectly natural (and expected) that a person would experience great sadness and might wish to be left alone following the death of a close family member. Because such reactions are in some ways culturally expected, the individual would not be assumed to signify a mental disorder.

Some believe that there is no essential criterion or set of criteria that can definitively distinguish all cases of disorder from nondisorder (Lilienfeld & Marino, 1999). In truth, no single approach to defining a psychological disorder is adequate by itself, nor is there universal agreement on where the boundary is between disordered and not disordered. From time to time we all experience anxiety, unwanted thoughts, and moments of sadness; our behavior at other times may not make much sense to ourselves or to others. These inner experiences and behaviors can vary in their intensity but are only considered disordered when they are highly disturbing to us and/or others, suggest a dysfunction in normal mental functioning, and are associated with significant distress or disability in social or occupational activities.

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READING 33

Diagnosing and Classifying Psychological Disorders

SOURCE

OpenStax. (2019). *Psychology.* OpenStax CNX. https://openstax.org/details/books/psychology

LEARNING OBJECTIVES

- Explain why classification systems are necessary in the study of psychopathology.
- Describe the basic features of the *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition *(DSM-5)*.
- Discuss changes in the *DSM* over time, including criticisms of the current edition.
- Identify which disorders are generally the most common.

KEY TERMS

comorbidity
diagnosis
Diagnostic and Statistical Manual of Mental Disorders (DSM-5)
International Classification of Diseases (ICD)

A first step in the study of psychological disorders is carefully and systematically discerning significant signs and symptoms. How do mental health professionals ascertain whether or not a person's inner states and behaviors truly represent a psychological disorder? Arriving at a proper **diagnosis**—that is, appropriately identifying and labeling a set of defined symptoms—is absolutely crucial. This process enables professionals to use a common language with others in the field and aids in communication about the disorder with the patient, colleagues, and the public. A proper diagnosis is an essential element to guide proper and successful treatment. For these reasons, classification systems that organize psychological disorders systematically are necessary.

THE DIAGNOSTIC AND STATISTICAL MANUAL OF MENTAL DISORDERS (DSM)

Although a number of classification systems have been developed over time, the one that is used by most mental health professionals in the United States is the ***Diagnostic and Statistical Manual of Mental Disorders (DSM-5)***, published by the American Psychiatric Association (2013). (Note that the American Psychiatric Association differs from the American Psychological Association, but both are abbreviated APA.) The first edition of the *DSM*, published in 1952, classified psychological disorders according to a format developed by the U.S. Army during World War II (Clegg, 2012). In the years since, the *DSM* has undergone numerous revisions and editions. The most recent edition, published in 2013, is the *DSM-5* (APA, 2013). The *DSM-5* includes many categories of disorders (e.g., anxiety disorders, depressive disorders, and dissociative disorders). Each disorder is described in detail, including an overview of the disorder (diagnostic features), specific symptoms required for diagnosis (diagnostic criteria), prevalence information (what percent of the population is thought to be afflicted with the disorder), and risk factors associated with the disorder. **FIGURE 33.1** shows lifetime prevalence rates—the percentage of people in a population who develop a disorder in their lifetime—of various psychological disorders among U.S. adults. These data were based on a national sample of 9,282 U.S. residents (National Comorbidity Survey, 2007).

The *DSM-5* also provides information about **comorbidity**; the co-occurrence of two disorders. For example, the *DSM-5* mentions that 41% of people with obsessive-compulsive disorder (OCD) also meet the diagnostic criteria for major depressive disorder (**FIGURE 33.2**). Drug use is highly comorbid with other mental illnesses; 6 out of 10 people who have a substance use disorder also suffer from another form of mental illness (National Institute on Drug Abuse, 2007).

The *DSM* has changed considerably in the half-century since it was originally published. The first two editions of the *DSM*, for example, listed homosexuality as a disorder; however, in 1973, the APA voted to remove it from the manual (Silverstein, 2009). Additionally, beginning with the *DSM-III* in 1980, mental disorders have been described in much greater detail, and the number of diagnosable conditions has grown steadily, as has the size of the manual itself. *DSM-I* included 106 diagnoses and was 130 total pages, whereas *DSM-III* included more than 2 times as many diagnoses (265) and was nearly seven times its size (886 total pages) (Mayes & Horowitz, 2005). Although *DSM-5* is longer than *DSM-IV*, the volume includes only 237 disorders, a decrease from the 297 disorders that were listed in *DSM-IV*. The latest edition, *DSM-5*, includes revisions in the organization and naming of

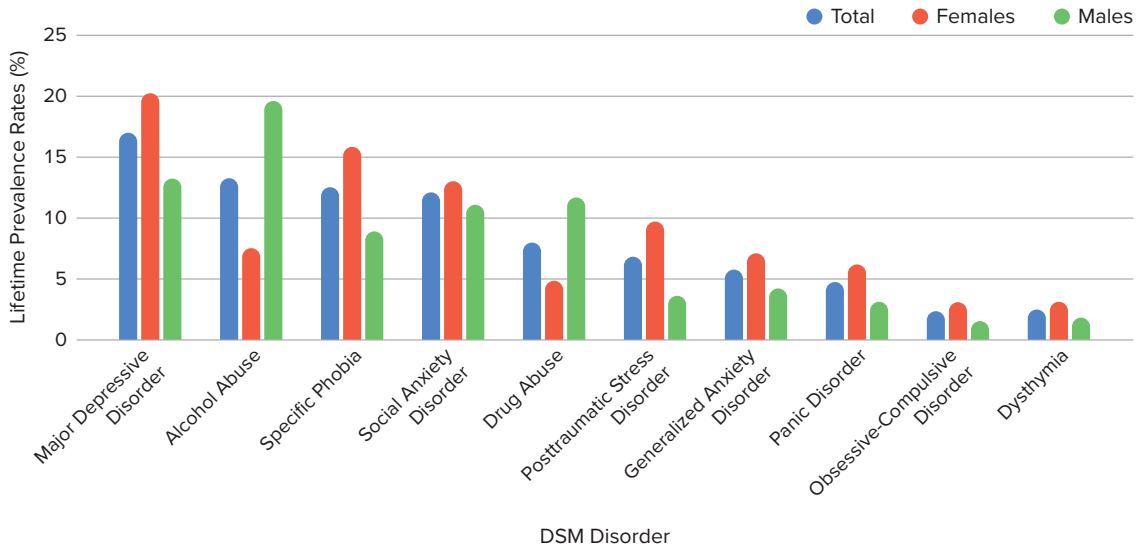

FIGURE 33.1. The breakdown of psychological disorders, comparing the percentage prevalence among adult males and adult females in the United States. Because the data is from 2007, the categories shown here are from the *DSM-IV*, which has been supplanted by the *DSM-5*. Most categories remain the same; however, alcohol abuse now falls under a broader Alcohol Use Disorder category. [This work, "Prevalence of Psychological Disorders," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of "Figure 15.4" by Rice University/OpenStax, which is licensed under CC BY 4.0.]

categories and in the diagnostic criteria for various disorders (Regier et al., 2012), while emphasizing careful consideration of the importance of gender and cultural difference in the expression of various symptoms (Fisher, 2010).

Some believe that establishing new diagnoses might overpathologize the human condition by turning common human problems into mental illnesses (The Associated Press, 2013). Indeed, the finding that nearly half of all Americans will meet the criteria for a *DSM* disorder at some point in their life (Kessler et al., 2005) likely fuels much of this skepticism. The *DSM-5* is also criticized on the grounds that its diagnostic criteria have been loosened, thereby threatening to "turn our current diagnostic inflation into diagnostic hyperinflation" (Frances, 2012, para. 22). For example, *DSM-IV* specified that the symptoms of major depressive disorder must not be attributable to normal bereavement (loss of a loved one). The *DSM-5*, however, has removed this bereavement exclusion, essentially meaning that grief and sadness after a loved one's death can constitute major depressive disorder.

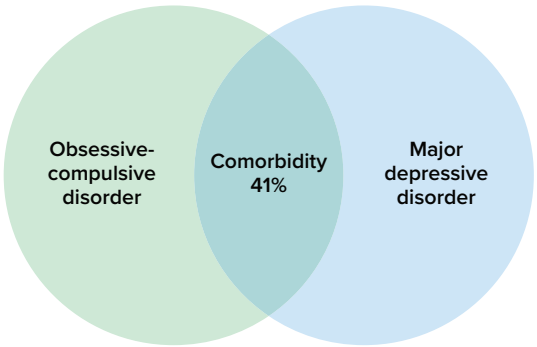

FIGURE 33.2. Obsessive-compulsive disorder and major depressive disorder frequently occur in the same person. ["OCD and MDD Comorbidity" by Judy Schmitt is licensed under CC BY-NC-SA 4.0.]

THE INTERNATIONAL CLASSIFICATION OF DISEASES

A second classification system, the ***International Classification of Diseases (ICD)***, is also widely recognized. Published by the World Health Organization (WHO), the *ICD* was developed in Europe shortly after World War II and, like the *DSM*, has been revised several times. The categories of psychological disorders in both the *DSM* and *ICD* are similar, as are the criteria for specific disorders; however, some differences exist. Although the *ICD* is used for clinical purposes, this tool is also used to examine the general health of populations and to monitor the prevalence of diseases and other health problems internationally (WHO, 2019). The *ICD* is in its 11th edition (*ICD-11*); this latest edition was designed, in conjunction with the changes in *DSM-5*, to help harmonize the two classification systems as much as possible (APA, 2013).

A study that compared the use of the two classification systems found that worldwide the *ICD* is more frequently used for clinical diagnosis, whereas the *DSM* is more valued for research (Mezzich, 2002). Most research findings concerning the etiology and treatment of psychological disorders are based on criteria set forth in the *DSM* (Oltmanns & Castonguay, 2013). The *DSM* also includes more explicit

disorder criteria, along with an extensive and helpful explanatory text (Regier et al., 2012). The *DSM* is the classification system of choice among U.S. mental health professionals, and this chapter is based on the *DSM* paradigm.

THE COMPASSIONATE VIEW OF PSYCHOLOGICAL DISORDERS

As these disorders are outlined, please bear two things in mind. First, remember that psychological disorders represent *extremes* of inner experience and behavior. If, while reading about these disorders, you feel that these descriptions begin to personally characterize you, do not worry—this moment of enlightenment probably means nothing more than you are normal. Each of us experiences episodes of sadness, anxiety, and preoccupation with certain thoughts—times when we do not quite feel ourselves. These episodes should not be considered problematic unless the accompanying thoughts and behaviors become extreme and have a disruptive effect on one's life. Second, understand that people with psychological disorders are far more than just embodiments of their disorders. We do not use terms such as schizophrenics, depressives, or phobics because they are labels that objectify people who suffer from these conditions, thus promoting biased and disparaging assumptions about them. It is important to remember that a psychological disorder is not what a person *is*; it is something that a person *has*—through no fault of his or her own. As is the case with cancer or diabetes, those with psychological disorders suffer debilitating, often painful conditions that are not of their own choosing. These individuals deserve to be viewed and treated with compassion, understanding, and dignity.

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READING 34

Anxiety and Related Disorders

David H. Barlow and Kristen K. Ellard

SOURCE

Barlow, D. H., & Ellard, K. K. (2020). Anxiety and related disorders. In R. Biswas-Diener & E. Diener (Eds.), *Noba textbook series: Psychology.* DEF Publishers. http://noba.to/xms3nq2c

LEARNING OBJECTIVES

- Understand the relationship between anxiety and anxiety disorders.
- Identify key vulnerabilities for developing anxiety and related disorders.
- Identify main diagnostic features of specific anxiety-related disorders.
- Differentiate between disordered and non-disordered functioning.

KEY TERMS

agoraphobia
anxiety
biological vulnerabilities
conditioned response
external cues
fight or flight
flashback
generalized anxiety disorder (GAD)
internal bodily or somatic cues
interoceptive avoidance
obsessive-compulsive disorder (OCD)
panic disorder (PD)
posttraumatic stress disorder (PTSD)
psychological vulnerabilities
reinforced
SAD performance only
social anxiety disorder (SAD)
specific vulnerabilities
thought-action fusion

Anxiety is a natural part of life and, at normal levels, helps us to function at our best. However, for people with anxiety disorders, anxiety is overwhelming and hard to control. Anxiety disorders develop out of a blend of biological (genetic) and psychological factors that, when combined with stress, may lead to the development of ailments. Primary anxiety-related diagnoses include generalized anxiety disorder, panic disorder, specific phobia, social anxiety disorder (social phobia), post traumatic stress disorder, and obsessive-compulsive disorder. In this module, we summarize the main clinical features of each of these disorders and discuss their similarities and differences with everyday experiences of anxiety.

INTRODUCTION

What is anxiety? Most of us feel some anxiety almost every day of our lives. Maybe you have an important test coming up for school. Or maybe there's that big game next Saturday, or that first date with someone new you are hoping to impress. **Anxiety** can be defined as a negative mood state that is accompanied by bodily symptoms such as increased heart rate, muscle tension, a sense of unease, and apprehension about the future (American Psychiatric Association [APA], 2013; Barlow, 2002).

Anxiety is what motivates us to plan for the future, and in this sense, anxiety is actually a good thing. It's the nagging feeling that motivates us to study for that test, practice harder for that game, or be at our very best on that date. But some people experience anxiety so intensely that it is no longer helpful or useful. They may become so overwhelmed and distracted by anxiety that they actually fail their test, fumble

While everyone may experience some level of anxiety at one time or another, those with anxiety disorders experience it consistently and so intensely that it has a significantly negative impact on their quality of life. ["Do we have enough clothes?? Is our house safe?? Is it difficult to change diapers?? Will I ever sleep the next 18 years???" by Bada Bing/Flickr is licensed under CC BY-NC-SA 2.0.]

the ball, or spend the whole date fidgeting and avoiding eye contact. If anxiety begins to interfere in the person's life in a significant way, it is considered a disorder.

Anxiety and closely related disorders emerge from "triple vulnerabilities," a combination of biological, psychological, and specific factors that increase our risk for developing a disorder (Barlow, 2002; Suárez et al., 2009). **Biological vulnerabilities** refer to specific genetic and neurobiological factors that might predispose someone to develop anxiety disorders. No single gene directly causes anxiety or panic, but our genes may make us more susceptible to anxiety and influence how our brains react to stress (Drabant et al., 2012; Gelernter & Stein, 2009; Smoller et al., 2009). **Psychological vulnerabilities** refer to the influences that our early experiences have on how we view the world. If we were confronted with unpredictable stressors or traumatic experiences at younger ages, we may come to view the world as unpredictable and uncontrollable, even dangerous (Chorpita & Barlow, 1998; Gunnar & Fisher, 2006). **Specific vulnerabilities** refer to how our experiences lead us to focus and channel our anxiety (Suárez et al., 2009). If we learned that physical illness is dangerous, maybe through witnessing our family's reaction whenever anyone got sick, we may focus our anxiety on physical sensations. If we learned that disapproval from others has negative, even dangerous consequences, such as being yelled at or severely punished for even the slightest offense, we might focus our anxiety on social evaluation. If we learn that the "other shoe might drop" at any moment, we may focus our anxiety on worries about the future. None of these vulnerabilities directly causes anxiety disorders on its own—instead, when all of these vulnerabilities are present, and we experience some triggering life stress, an anxiety disorder may be the result (Barlow, 2002; Suárez et al., 2009). In the next sections, we will briefly explore each of the major anxiety-based disorders, found in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)* (APA, 2013).

GENERALIZED ANXIETY DISORDER

Most of us worry some of the time, and this worry can actually be useful in helping us plan for the future or make sure we remember to do something important. Most of us can set aside our worries when we need to focus on other things or stop worrying altogether whenever a problem has passed. However, for someone with **generalized anxiety disorder (GAD)**, these worries become difficult, or even impossible, to turn off. They may find themselves worrying excessively about a number of different things, both minor and catastrophic. Their worries also come with a host of other symptoms such as muscle tension, fatigue, agitation or restlessness, irritability, difficulties with sleep (either falling asleep, staying asleep, or both), or difficulty concentrating. The *DSM-5* criteria specify that at least six months of excessive anxiety and worry of this type must be ongoing, happening more days than not for a good proportion of the day, to receive a diagnosis of GAD. About 5.7% of the population has met criteria for GAD at some point during their lifetime (Kessler, Berglund, et al., 2005), making it one of the most common anxiety disorders (see **TABLE 34.1**).

What makes a person with GAD worry more than the average person? Research shows that individuals with GAD are more sensitive and vigilant toward possible threats than people who are not anxious (Aikins & Craske, 2001; Barlow, 2002; Bradley et al., 1999). This may be related to early stressful experiences, which can lead to a view of the world as an unpredictable, uncontrollable, and even dangerous place. Some have suggested that people with GAD worry as a way to gain some control over these otherwise uncontrollable or unpredictable experiences and against uncertain outcomes (Dugas et al., 1998). By repeatedly going through all of the possible "What if?" scenarios in their mind, the person might feel like they are less vulnerable to an unexpected outcome, giving them the sense that they have *some* control over the situation (Wells, 2002). Others have suggested people with GAD worry as a way to avoid feeling distressed (Borkovec et al., 2004). For example, Borkovec and Hu (1990) found that those who worried when confronted with a stressful situation had less physiological arousal than those who didn't worry, maybe because the worry "distracted" them in some way.

The problem is, all of this "what if?"-ing doesn't get the person any closer to a solution or an answer and, in fact,

TABLE 34.1. Prevalence Rates for Major Anxiety Disorders

Disorder	1-Year Prevalence Rates[1]	Lifetime Prevalence Rates[2]	Prevalence by Gender	Median Age of Onset
Generalized Anxiety Disorder	3.1%	5.7%	67% female	31 years
OCD	1.0%	1.6%	55% female	19 years
Panic Disorder	2.7%	4.7%	67% female	24 years
PTSD	3.5%	6.8%	52% female[3]	23 years
Social Anxiety	6.8%	12.1%	50% female	13 years
Specific Phobia	8.7%	12.5%	60%–90% female[4]	7–9 years

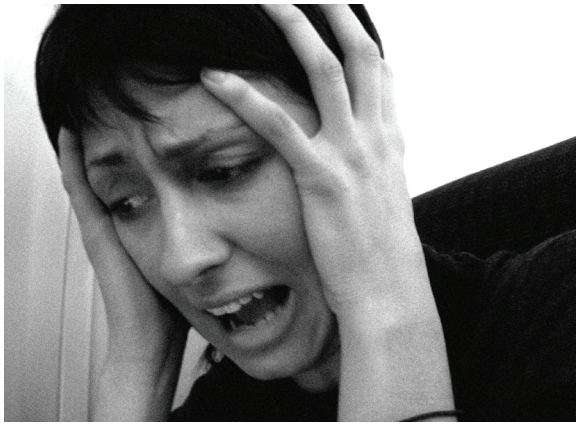
[1] Kessler, Berglund, et al. (2005), [2] Kessler, Chiu, et al. (2005), [3] Kessler et al. (1995), [4] Craske et al. (2006).

might take them away from important things they should be paying attention to in the moment, such as finishing an important project. Many of the catastrophic outcomes people with GAD worry about are very unlikely to happen, so when the catastrophic event doesn't materialize, the act of worrying gets **reinforced** (Borkovec et al., 1999). For example, if a mother spends all night worrying about whether her teenage daughter will get home safe from a night out and the daughter returns home without incident, the mother could easily attribute her daughter's safe return to her successful "vigil." What the mother hasn't learned is that her daughter would have returned home just as safe if she had been focusing on the movie she was watching with her husband, rather than being preoccupied with worries. In this way, the cycle of worry is perpetuated, and, subsequently, people with GAD often miss out on many otherwise enjoyable events in their lives.

PANIC DISORDER AND AGORAPHOBIA

Have you ever gotten into a near-accident or been taken by surprise in some way? You may have felt a flood of physical sensations, such as a racing heart, shortness of breath, or tingling sensations. This alarm reaction is called the "**fight or flight**" response (Cannon, 1929) and is your body's natural reaction to fear, preparing you to either fight or escape in response to threat or danger. It's likely you weren't too concerned with these sensations, because you knew what was causing them. But imagine if this alarm reaction came "out of the blue," for no apparent reason, or in a situation in which you didn't expect to be anxious or fearful. This is called an "unexpected" panic attack or a false alarm. Because there is no apparent reason or cue for the alarm reaction, you might react to the sensations with intense fear, maybe thinking you are having a heart attack, or going crazy, or even dying. You might begin to associate the physical sensations you felt during this attack with this fear and may start to go out of your way to avoid having those sensations again.

Unexpected panic attacks such as these are at the heart of **panic disorder (PD)**. However, to receive a diagnosis of PD, the person must not only have unexpected panic attacks but also must experience continued intense anxiety and avoidance related to the attack for at least one month, causing significant distress or interference in their lives. People with panic disorder tend to interpret even normal physical sensations in a catastrophic way, which triggers more anxiety and, ironically, more physical sensations, creating a vicious cycle of panic (Clark, 1986, 1996). The person may begin to avoid a number of situations or activities that produce the same physiological arousal that was present during the beginnings of a panic attack. For example, someone who experienced a racing heart during a panic attack might avoid exercise or caffeine. Someone who experienced choking sensations might avoid wearing high-necked sweaters or necklaces. Avoidance



Panic disorder is a debilitating condition that leaves sufferers with acute anxiety that persists long after a specific panic attack has subsided. When this anxiety leads to deliberate avoidance of particular places and situations, a person may be given a diagnosis of agoraphobia. []

of these **internal bodily or somatic cues** for panic has been termed **interoceptive avoidance** (Barlow & Craske, 2007; Brown et al., 2005; Craske & Barlow, 2008; Shear et al., 1997).

The individual may also have experienced an overwhelming urge to escape during the unexpected panic attack. This can lead to a sense that certain places or situations—particularly situations where escape might not be possible—are not "safe." These situations become **external cues** for panic. If the person begins to avoid several places or situations, or still endures these situations but does so with a significant amount of apprehension and anxiety, then the person also has **agoraphobia** (Barlow, 2002; Craske & Barlow, 1988, 2008). Agoraphobia can cause significant disruption to a person's life, causing them to go out of their way to avoid situations, such as adding hours to a commute to avoid taking the train or only ordering take-out to avoid having to enter a grocery store. In one tragic case seen by our clinic, a woman suffering from agoraphobia had not left her apartment for 20 years and had spent the past 10 years confined to one small area of her apartment, away from the view of the outside. In some cases, agoraphobia develops in the absence of panic attacks and therefor is a separate disorder in *DSM-5*. But agoraphobia often accompanies panic disorder.

About 4.7% of the population has met criteria for PD or agoraphobia over their lifetime (Kessler, Chiu, et al., 2005; Kessler et al., 2006) (see **TABLE 34.1**). In all of these cases of panic disorder, what was once an adaptive natural alarm reaction now becomes a learned, and much feared, false alarm.

SPECIFIC PHOBIA

The majority of us might have certain things we fear, such as bees, or needles, or heights (Myers et al., 1984). But what if this fear is so consuming that you can't go out on a summer's

day, or get vaccines needed to go on a special trip, or visit your doctor in her new office on the 26th floor? To meet criteria for a diagnosis of specific phobia, there must be an irrational fear of a specific object or situation that substantially interferes with the person's ability to function. For example, a patient at our clinic turned down a prestigious and coveted artist residency because it required spending time near a wooded area, bound to have insects. Another patient purposely left her house two hours early each morning so she could walk past her neighbor's fenced yard before they let their dog out in the morning.

The list of possible phobias is staggering, but four major subtypes of specific phobia are recognized: blood-injury-injection (BII) type, situational type (such as planes, elevators, or enclosed places), natural environment type for events one may encounter in nature (for example, heights, storms, and water), and animal type.

A fifth category, "other," includes phobias that do not fit any of the four major subtypes (for example, fears of choking, vomiting, or contracting an illness). Most phobic reactions cause a surge of activity in the sympathetic nervous system and increased heart rate and blood pressure, maybe even a panic attack. However, people with BII type phobias usually experience a marked *drop* in heart rate and blood pressure and may even faint. In this way, those with BII phobias almost always differ in their physiological reaction from people with other types of phobia (Barlow & Liebowitz, 1995; Craske et al., 2006; Hofmann et al., 2009; Öst, 1992). BII phobia also runs in families more strongly than any phobic disorder we know (Antony & Barlow, 2002; Page & Martin, 1998). Specific phobia is one of the most common psychological disorders in the United States, with 12.5% of the population reporting a lifetime history of fears significant enough to be considered a "phobia" (Arrindell et al., 2003; Kessler, Berglund, et al., 2005) (see **TABLE 34.1**). Most people who suffer from specific phobia tend to have multiple phobias of several types (Hofmann et al., 1997).

Elevators can be a trigger for sufferers of claustrophobia or agoraphobia. ["Project365/Day 93: A casa" by srgpicker/Flickr is licensed under CC BY-NC 2.0.]

SOCIAL ANXIETY DISORDER (SOCIAL PHOBIA)

Many people consider themselves shy, and most people find social evaluation uncomfortable at best, or giving a speech somewhat mortifying. Yet, only a small proportion of the population fear these types of situations significantly enough to merit a diagnosis of **social anxiety disorder (SAD)** (APA, 2013). SAD is more than exaggerated shyness (Bögels et al., 2010; Schneier et al., 1996). To receive a diagnosis of SAD, the fear and anxiety associated with social situations must be so strong that the person avoids them entirely, or if avoidance is not possible, the person endures them with a great deal of distress. Further, the fear and avoidance of social situations must get in the way of the person's daily life or seriously limit their academic or occupational functioning. For example, a patient at our clinic compromised her perfect 4.0 grade point average because she could not complete a required oral presentation in one of her classes, causing her to fail the course. Fears of negative evaluation might make someone repeatedly turn down invitations to social events or avoid having conversations with people, leading to greater and greater isolation.

The specific social situations that trigger anxiety and fear range from one-on-one interactions, such as starting or maintaining a conversation; to performance-based situations, such as giving a speech or performing on stage; to assertiveness, such as asking someone to change disruptive or undesirable behaviors. Fear of social evaluation might even extend to such things as using public restrooms, eating in a restaurant, filling out forms in a public place, or even reading on a train. Any type of situation that could potentially draw attention to the person can become a feared social situation. For example, one patient of ours went out of her way to avoid any situation in which she might have to use a public restroom for fear that someone would hear her in the bathroom stall and think she was disgusting. If the fear is limited to performance-based situations, such as public speaking, a diagnosis of **SAD performance only** is assigned.

What causes someone to fear social situations to such a large extent? The person may have learned growing up that social evaluation in particular can be dangerous, creating a specific psychological vulnerability to develop social anxiety (Bruch & Heimberg, 1994; Lieb et al., 2000; Rapee & Melville, 1997). For example, the person's caregivers may have harshly criticized and punished them for even the smallest mistake, maybe even punishing them physically.

Or, someone might have experienced a social trauma that had lasting effects, such as being bullied or humiliated.

Social trauma in childhood may have long-lasting effects. ["School Bully" by ihtatho/Flickr is licensed under CC BY-NC 2.0.]

Interestingly, one group of researchers found that 92% of adults in their study sample with social phobia experienced severe teasing and bullying in childhood, compared with only 35% to 50% among people with other anxiety disorders (McCabe et al., 2003). Someone else might react so strongly to the anxiety provoked by a social situation that they have an unexpected panic attack. This panic attack then becomes associated (**conditioned response**) with the social situation, causing the person to fear they will panic the next time they are in that situation. This is not considered PD, however, because the person's fear is more focused on social evaluation than having unexpected panic attacks, and the fear of having an attack is limited to social situations. As many as 12.1% of the general population suffer from social phobia at some point in their lives (Kessler, Berglund, et al., 2005), making it one of the most common anxiety disorders, second only to specific phobia (see **TABLE 34.1**).

POSTTRAUMATIC STRESS DISORDER

With stories of war, natural disasters, and physical and sexual assault dominating the news, it is clear that trauma is a reality for many people. Many individual traumas that occur every day never even make the headlines, such as a car accident, domestic abuse, or the death of a loved one. Yet, while many people face traumatic events, not everyone who faces a trauma develops a disorder. Some, with the help of family and friends, are able to recover and continue on with their lives (Friedman, 2009). For some, however, the months and years following a trauma are filled with intrusive reminders of the event, a sense of intense fear that another traumatic event might occur, or a sense of isolation and emotional numbing. They may engage in a host of behaviors intended to protect themselves from being vulnerable or unsafe, such as constantly scanning their surroundings to look for signs of potential danger, never sitting with their back to the door, or never allowing themselves to be anywhere alone. This lasting reaction to trauma is what characterizes **posttraumatic stress disorder (PTSD)**.

A diagnosis of PTSD begins with the traumatic event itself. An individual must have been exposed to an event that involves actual or threatened death, serious injury, or sexual violence. To receive a diagnosis of PTSD, exposure to the event must include either directly experiencing the event, witnessing the event happening to someone else, learning that the event occurred to a close relative or friend, or having repeated or extreme exposure to details of the event (such as in the case of first responders). The person subsequently re-experiences the event through both intrusive memories and nightmares. Some memories may come back so vividly that the person feels like they are experiencing the event all over again, what is known as having a **flashback**. The individual may avoid anything that reminds them of the trauma, including conversations, places, or even specific types of people. They may feel emotionally numb or restricted in their ability to feel, which may interfere in their interpersonal relationships. The person may not be able to remember certain aspects of what happened during the event. They may feel a sense of a foreshortened future, that they will never marry, have a family, or live a long, full life. They may be jumpy or easily startled, hypervigilant to their surroundings, and quick to anger. The prevalence of PTSD among the population as a whole is relatively low, with 6.8% having experienced PTSD at some point in their life (Kessler, Berglund, et al., 2005) (see **TABLE 34.1**). Combat and sexual assault are the most common precipitating traumas (Kessler et al., 1995). Whereas PTSD was previously categorized as an Anxiety Disorder, in the most recent version of the *DSM* (*DSM-5*) (APA, 2013) it has been reclassified under the more specific category of Trauma- and Stressor-Related Disorders.

A person with PTSD is particularly sensitive to both internal and external cues that serve as reminders of their traumatic experience. For example, as we saw in PD, the physical sensations of arousal present during the initial trauma can become threatening in and of themselves, becoming a powerful reminder of the event. Someone might avoid watching intense or emotional movies in order to prevent the experience of emotional arousal. Avoidance of conversations, reminders, or even of the experience of emotion itself may also be an attempt to avoid triggering internal cues. External stimuli that were present during the trauma can also become strong triggers. For example, if a woman is raped by a man wearing a red t-shirt, she may develop a strong alarm reaction to the sight of red shirts, or perhaps even more indiscriminately to anything with a similar color red. A combat veteran who experienced a strong smell of gasoline during a roadside bomb attack may have an intense alarm reaction when pumping gas back at home. Individuals with a psychological vulnerability toward viewing the world as uncontrollable and unpredictable may particularly struggle with the possibility

of additional future, unpredictable traumatic events, fueling their need for hypervigilance and avoidance and perpetuating the symptoms of PTSD.

OBSESSIVE-COMPULSIVE DISORDER

Have you ever had a strange thought pop into your mind, such as picturing the stranger next to you naked? Or maybe you walked past a crooked picture on the wall and couldn't resist straightening it. Most people have occasional strange thoughts and may even engage in some "compulsive" behaviors, especially when they are stressed (Boyer & Liénard, 2008; Fullana et al., 2009). But for most people, these thoughts are nothing more than a passing oddity, and the behaviors are done (or not done) without a second thought. For someone with **obsessive-compulsive disorder (OCD)**, however, these thoughts and compulsive behaviors don't just come and go. Instead, strange or unusual thoughts are taken to mean something much more important and real, maybe even something dangerous or frightening. The urge to engage in some behavior, such as straightening a picture, can become so intense that it is nearly impossible *not* to carry it out, or causes significant anxiety if it can't be carried out. Further, someone with OCD might become preoccupied with the possibility that the behavior wasn't carried out to completion and feel compelled to repeat the behavior again and again, maybe several times before they are "satisfied."

To receive a diagnosis of OCD, a person must experience obsessive thoughts and/or compulsions that seem irrational or nonsensical but that keep coming into their mind. Some examples of obsessions include doubting thoughts (such as doubting a door is locked or an appliance is turned off), thoughts of contamination (such as thinking that touching almost anything might give you cancer), or aggressive thoughts or images that are unprovoked or nonsensical. Compulsions may be carried out in an attempt to neutralize some of these thoughts, providing temporary relief from the anxiety the obsessions cause, or they may be nonsensical in and of themselves. Either way, compulsions are distinct in that they must be repetitive or excessive, the person feels "driven" to carry out the behavior, and the person feels a great deal of distress if they can't engage in the behavior. Some examples of compulsive behaviors are repetitive washing (often in response to contamination obsessions), repetitive checking (locks, door handles, appliances, often in response to doubting obsessions), ordering and arranging things to ensure symmetry, or doing things according to a specific ritual or sequence (such as getting dressed or ready for bed in a specific order). To meet diagnostic criteria for OCD, engaging in obsessions and/or compulsions must take up a significant amount of the person's time, at least an hour per day, and must cause significant distress or impairment in functioning. About 1.6% of the population has met criteria for OCD over the course of a lifetime (Kessler, Berglund, et al., 2005) (see **TABLE 34.1**). Whereas OCD was previously categorized as an Anxiety Disorder, in the most recent version of the *DSM* (*DSM-5*) (APA, 2013) it has been reclassified under the more specific category of Obsessive-Compulsive and Related Disorders.

People with OCD often confuse having an intrusive thought with their potential for carrying out the thought. Whereas most people when they have a strange or frightening thought are able to let it go, a person with OCD may become "stuck" on the thought and be intensely afraid that they might somehow lose control and act on it. Or worse, they believe that having the thought is just as bad as doing it. This is called **thought-action fusion**. For example, one patient of ours was plagued by thoughts that she would cause harm to her young daughter. She experienced intrusive images of throwing hot coffee in her daughter's face or pushing her face underwater when she was giving her a bath. These images were so terrifying to the patient that she would no longer allow herself any physical contact with her daughter and would leave her daughter in the care of a babysitter if her husband or another family was not available to "supervise" her. In reality, the last thing she wanted to do was harm her daughter, and she had no intention or desire to act on the aggressive thoughts and images, nor does anybody with OCD act on these thoughts, but these thoughts were so horrifying to her that she made every attempt to prevent herself from the potential of carrying them out, even if it meant not being able to hold, cradle, or cuddle her daughter. These are the types of struggles people with OCD face every day.

People suffering from OCD may have an irrational fear of germs and "becoming contaminated." ["Yes, you may have an obsession or two. Perhaps a couple of compulsions. But..." by benjamin sTone/Flickr is licensed under CC BY-NC-SA 2.0.]

TREATMENTS FOR ANXIETY AND RELATED DISORDERS

Many successful treatments for anxiety and related disorders have been developed over the years. Medications (anti-anxiety drugs and antidepressants) have been found to be beneficial for disorders other than specific phobia, but relapse rates are high once medications are stopped (Heimberg et al., 1998; Hollon et al., 2005), and some classes of medications (minor tranquilizers or benzodiazepines) can be habit forming.

Exposure-based cognitive-behavioral therapies (CBT) are effective psychosocial treatments for anxiety disorders, and many show greater treatment effects than medication in the long term (Barlow et al., 2000, 2007). In CBT, patients are taught skills to help identify and change problematic thought processes, beliefs, and behaviors that tend to worsen symptoms of anxiety, and practice applying these skills to real-life situations through exposure exercises. Patients learn how the automatic "appraisals" or thoughts they have about a situation affect both how they feel and how they behave. Similarly, patients learn how engaging in certain behaviors, such as avoiding situations, tends to strengthen the belief that the situation is something to be feared. A key aspect of CBT is exposure exercises, in which the patient learns to gradually approach situations they find fearful or distressing, in order to challenge their beliefs and learn new, less fearful associations about these situations.

Typically 50% to 80% of patients receiving drugs or CBT will show a good initial response, with the effect of CBT more durable. Newer developments in the treatment of anxiety disorders are focusing on novel interventions, such as the use of certain medications to enhance learning during CBT (Otto et al., 2010) and transdiagnostic treatments targeting core, underlying vulnerabilities (Barlow et al., 2011). As we advance our understanding of anxiety and related disorders, so too will our treatments advance, with the hopes that for the many people suffering from these disorders, anxiety can once again become something useful and adaptive, rather than something debilitating.

Exposure-based CBT aims to help patients recognize and change problematic thoughts and behaviors in real-life situations. A person with a fear of elevators would be encouraged to practice exposure exercises that might involve approaching or riding elevators to attempt to overcome their anxiety. ["Elevator" by Tom Magliery/Flickr is licensed under CC BY-NC-SA 2.0.]

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READING 35

Mood Disorders

Anda Gershon and Renee Thompson

SOURCE

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LEARNING OBJECTIVES

- Describe the diagnostic criteria for mood disorders.
- Understand age, gender, and ethnic differences in prevalence rates of mood disorders.
- Identify common risk factors for mood disorders.
- Know effective treatments of mood disorders.

KEY TERMS

anhedonia
attributional styles
chronic stress
early adversity
grandiosity
hypersomnia
psychomotor agitation
psychomotor retardation
social zeitgeber theory
socioeconomic status
suicidal ideation

Everyone feels down or euphoric from time to time, but this is different from having a mood disorder such as major depressive disorder or bipolar disorder. Mood disorders are extended periods of depressed, euphoric, or irritable moods that in combination with other symptoms cause the person significant distress and interfere with his or her daily life, often resulting in social and occupational difficulties. In this module, we describe major mood disorders, including their symptom presentations, general prevalence rates, and how and why the rates of these disorders tend to vary by age, gender, and race. In addition, biological and environmental risk factors that have been implicated in the development and course of mood disorders, such as heritability and stressful life events, are reviewed. Finally, we provide an overview of treatments for mood disorders, covering treatments with demonstrated effectiveness, as well as new treatment options showing promise.

INTRODUCTION

The actress Brooke Shields (2005) published a memoir titled *Down Came the Rain: My Journey through Postpartum Depression*, in which she described her struggles with depression following the birth of her daughter. Despite the fact that about one in 20 women experience depression after the birth of a baby (American Psychiatric Association [APA], 2013), postpartum depression—recently renamed "perinatal depression"—continues to be veiled by stigma, owing in part to a widely held expectation that motherhood should be a time of great joy. In an opinion piece in the *New York Times*, Shields revealed that entering motherhood was a profoundly overwhelming experience for her. She vividly describes experiencing a sense of "doom" and "dread" in response to her newborn baby. Because motherhood is conventionally thought of as a joyous event and not associated with sadness and hopelessness, responding to a newborn baby in this way can be shocking to the new mother as well as those close to her. It may also involve a great deal of shame for the mother, making her reluctant to divulge her experience to others, including her doctors and family.

Feelings of shame are not unique to perinatal depression. Stigma applies to other types of depressive and bipolar

Perinatal depression following childbirth afflicts about 5% of all mothers. An unfortunate social stigma regarding this form of depression compounds the problem for the women who suffer its effects. ["baby-1866621" by Pexels/Pixabay is in the public domain.]

disorders and contributes to people not always receiving the necessary support and treatment for these disorders. In fact, the World Health Organization ranks both major depressive disorder (MDD) and bipolar disorder (BD) among the top 10 leading causes of disability worldwide. Further, MDD and BD carry a high risk of suicide. It is estimated that 25% to 50% of people diagnosed with BD will attempt suicide at least once in their lifetimes (Goodwin & Jamison, 2007).

WHAT ARE MOOD DISORDERS?

Mood Episodes

Everyone experiences brief periods of sadness, irritability, or euphoria. This is different than having a mood disorder, such as MDD or BD, which are characterized by a constellation of symptoms that causes people significant distress or impairs their everyday functioning.

Major Depressive Episode

A major depressive episode (MDE) refers to symptoms that co-occur for at least two weeks and cause significant distress or impairment in functioning, such as interfering with work, school, or relationships. Core symptoms include feeling down or depressed or experiencing **anhedonia**—loss of interest or pleasure in things that one typically enjoys. According to the fifth edition of the *Diagnostic and Statistical Manual* (*DSM-5)* (APA, 2013), the criteria for an MDE require five or more of the following symptoms, including one or both of the first two symptoms, for most of the day, nearly every day:

1. Depressed mood
2. Diminished interest or pleasure in almost all activities
3. Significant weight loss or gain or an increase or decrease in appetite
4. Insomnia or **hypersomnia**
5. **Psychomotor agitation** or **retardation**
6. Fatigue or loss of energy
7. Feeling worthless or excessive or inappropriate guilt
8. Diminished ability to concentrate or indecisiveness
9. Recurrent thoughts of death, **suicidal ideation**, or a suicide attempt

These symptoms cannot be caused by physiological effects of a substance or a general medical condition (e.g., hypothyroidism).

Manic or Hypomanic Episode

The core criterion for a manic or hypomanic episode is a distinct period of abnormally and persistently euphoric, expansive, or irritable mood and persistently increased goal-directed activity or energy. The mood disturbance must be present for one week or longer in mania (unless hospitalization is required) or four days or longer in hypomania. Concurrently, at least three of the following symptoms must be present in the context of euphoric mood (or at least four in the context of irritable mood):

1. Inflated self-esteem or **grandiosity**
2. Increased goal-directed activity or psychomotor agitation
3. Reduced need for sleep
4. Racing thoughts or flight of ideas
5. Distractibility
6. Increased talkativeness
7. Excessive involvement in risky behaviors

Manic episodes are distinguished from hypomanic episodes by their duration and associated impairment; whereas manic episodes must last one week and are defined by a significant impairment in functioning, hypomanic episodes are shorter and not necessarily accompanied by impairment in functioning.

Mood Disorders

Unipolar Mood Disorders

Two major types of unipolar disorders described by the *DSM-5* (APA, 2013) are major depressive disorder and persistent depressive disorder (PDD; dysthymia). MDD is defined by one or more MDEs but no history of manic or hypomanic episodes. Criteria for PDD are feeling depressed most of the day for more days than not, for at least two years. At least two of the following symptoms are also required to meet criteria for PDD:

1. Poor appetite or overeating
2. Insomnia or hypersomnia
3. Low energy or fatigue
4. Low self-esteem
5. Poor concentration or difficulty making decisions
6. Feelings of hopelessness

Like MDD, these symptoms need to cause significant distress or impairment and cannot be due to the effects of a substance or a general medical condition. To meet criteria for PDD, a person cannot be without symptoms for more than two months at a time. PDD has overlapping symptoms with MDD. If someone meets criteria for an MDE during a PDD episode, the person will receive diagnoses of PDD and MDD.

Bipolar Mood Disorders

Three major types of BDs are described by the *DSM-5* (APA, 2013). Bipolar I Disorder (BD I), which was previously known as manic-depression, is characterized by a single (or recurrent) manic episode. A depressive episode is not necessary but commonly present for the diagnosis of BD I. Bipolar II Disorder is characterized by single (or recurrent) hypomanic episodes and depressive episodes. Another type of BD is cyclothymic disorder, characterized by numerous

Bipolar disorders are characterized by cycles of high energy and depression. [Untitled image by Brett Whaley/Flickr is licensed under CC BY-NC 2.0.]

and alternating periods of hypomania and depression, lasting at least two years. To qualify for cyclothymic disorder, the periods of depression cannot meet full diagnostic criteria for an MDE; the person must experience symptoms at least half the time with no more than two consecutive symptom-free months; and the symptoms must cause significant distress or impairment.

It is important to note that the *DSM-5* was published in 2013, and findings based on the updated manual will be forthcoming. Consequently, the research presented below was largely based on a similar, but not identical, conceptualization of mood disorders drawn from the *DSM-IV* (APA, 2000).

HOW COMMON ARE MOOD DISORDERS? WHO DEVELOPS MOOD DISORDERS?

Depressive Disorders

In a nationally representative sample, lifetime prevalence rate for MDD is 16.6% (Kessler et al., 2005). This means that nearly one in five Americans will meet the criteria for MDD during their lifetime. The 12-month prevalence—the proportion of people who meet criteria for a disorder during a 12-month period—for PDD is approximately 0.5% (APA, 2013).

Although the onset of MDD can occur at any time throughout the lifespan, the average age of onset is mid-20s, with the age of onset decreasing with people born more recently (APA, 2000). Prevalence of MDD among older adults is much lower than it is for younger cohorts (Kessler et al., 2010). The duration of MDEs varies widely. Recovery begins within three months for 40% of people with MDD and within 12 months for 80% (APA, 2013). MDD tends to be a recurrent disorder with about 40% to 50% of those who experience one MDE experiencing a second MDE (Monroe & Harkness, 2011). An earlier age of onset predicts a worse course.

About 5% to 10% of people who experience an MDE will later experience a manic episode (APA, 2000), thus no longer meeting criteria for MDD but instead meeting them for BD I. Diagnoses of other disorders across the lifetime are common for people with MDD: 59% experience an anxiety disorder; 32% experience an impulse control disorder, and 24% experience a substance use disorder (Kessler et al., 2007).

Women experience two to three times higher rates of MDD than do men (Nolen-Hoeksema & Hilt, 2009). This gender difference emerges during puberty (Conley & Rudolph, 2009). Before puberty, boys exhibit similar or higher prevalence rates of MDD than do girls (Twenge & Nolen-Hoeksema, 2002). MDD is inversely correlated with **socioeconomic status** (SES), a person's economic and social position based on income, education, and occupation. Higher prevalence rates of MDD are associated with lower SES (Lorant et al., 2003), particularly for adults over 65 years old (Kessler et al., 2010). Independent of SES, results from a nationally representative sample found that European Americans had a higher prevalence rate of MDD than did African Americans and Hispanic Americans, whose rates were similar (Breslau et al., 2006). The course of MDD for African Americans is often more severe and less often treated than it is for European Americans, however (Williams et al., 2007). Native Americans have a higher prevalence rate than do European Americans, African Americans, or Hispanic Americans (Hasin et al., 2005). Depression

SPECIFIERS

Both MDEs and manic episodes can be further described using standardized tags based on the timing of, or other symptoms that are occurring during, the mood episode, to increase diagnostic specificity and inform treatment. *Psychotic features* is specified when the episodes are accompanied by delusions (rigidly held beliefs that are false) or hallucinations (perceptual disturbances that are not based in reality). *Seasonal pattern* is specified when a mood episode occurs at the same time of the year for two consecutive years—most commonly occurring in the fall and winter. *Peripartum onset* is specified when a mood episode has an onset during pregnancy or within four weeks of the birth of a child. Approximately 3% to 6% of women who have a child experience an MDE with peripartum onset (APA, 2013). This is less frequent and different from the baby blues or when women feel transient mood symptoms usually within 10 days of giving birth, which are experienced by most women (Nolen-Hoeksema & Hilt, 2009). ■

is not limited to industrialized or western cultures; it is found in all countries that have been examined, although the symptom presentation as well as prevalence rates vary across cultures (Chentsova-Dutton & Tsai, 2009).

Bipolar Disorders

The lifetime prevalence rate of bipolar spectrum disorders in the general U.S. population is estimated at approximately 4.4%, with BD I constituting about 1% of this rate (Merikangas et al., 2007). Prevalence estimates, however, are highly dependent on the diagnostic procedures used (e.g., interviews vs. self-report) and whether or not sub-threshold forms of the disorder are included in the estimate. BD often co-occurs with other psychiatric disorders. Approximately 65% of people with BD meet diagnostic criteria for at least one additional psychiatric disorder, most commonly anxiety disorders and substance use disorders (McElroy et al., 2001). The co-occurrence of BD with other psychiatric disorders is associated with poorer illness course, including higher rates of suicidality (Leverich et al., 2003). A recent cross-national study sample of more than 60,000 adults from 11 countries estimated the worldwide prevalence of BD at 2.4%, with BD I constituting 0.6% of this rate (Merikangas et al., 2011). In this study, the prevalence of BD varied somewhat by country. Whereas the United States had the highest lifetime prevalence (4.4%), India had the lowest (0.1%). Variation in prevalence rates was not necessarily related to SES, as in the case of Japan, a high-income country with a very low prevalence rate of BD (0.7%).

With regard to ethnicity, data from studies not confounded by SES or inaccuracies in diagnosis are limited, but available reports suggest rates of BD among European Americans are similar to those found among African Americans (Blazer et al., 1985) and Hispanic Americans (Breslau et al., 2005). Another large community-based study found that although prevalence rates of mood disorders were similar across ethnic groups, Hispanic Americans and African Americans with a mood disorder were more likely to remain persistently ill than European Americans (Breslau et al., 2005). Compared with European Americans with BD, African Americans tend to be underdiagnosed for BD (and over-diagnosed for schizophrenia) (Kilbourne et al., 2004; Minsky et al., 2003), and Hispanic Americans with BD have been shown to receive fewer psychiatric medication prescriptions and specialty treatment visits (Gonzalez et al., 2007). Misdiagnosis of BD can result in the underutilization of treatment or the utilization of inappropriate treatment, and thus profoundly impact the course of illness.

As with MDD, adolescence is known to be a significant risk period for BD; mood symptoms start by adolescence in roughly half of BD cases (Leverich et al., 2007; Perlis et al., 2004). Longitudinal studies show that those diagnosed with BD prior to adulthood experience a more pernicious course of illness relative to those with adult onset, including more episode recurrence, higher rates of suicidality, and profound social, occupational, and economic repercussions (e.g., Lewinsohn et al., 2002). The prevalence of BD is substantially lower in older adults compared with younger adults (1% vs. 4%) (Merikangas et al., 2007).

Adolescents experience a higher incidence of bipolar spectrum disorders than do adults. Making matters worse, those who are diagnosed with BD at a younger age seem to suffer symptoms more intensely than those with adult onset. ["desperate-2100307" by Anemone123/Pixabay is in the public domain.]

WHAT ARE SOME OF THE FACTORS IMPLICATED IN THE DEVELOPMENT AND COURSE OF MOOD DISORDERS?

Mood disorders are complex disorders resulting from multiple factors. Causal explanations can be attempted at various levels, including biological and psychosocial levels. Below, several of the key factors that contribute to onset and course of mood disorders are highlighted.

Depressive Disorders

Research across family and twin studies has provided support that genetic factors are implicated in the development of MDD. Twin studies suggest that familial influence on MDD is mostly due to genetic effects and that individual-specific environmental effects (e.g., romantic relationships) play an important role, too. By contrast, the contribution of shared environmental effect by siblings is negligible (Sullivan et al., 2000). The mode of inheritance is not fully understood, although no single genetic variation has been found to increase the risk of MDD significantly. Instead, several genetic variants and environmental factors most likely contribute to the risk for MDD (Lohoff, 2010).

Romantic relationships can affect mood, as in the case of divorce or the death of a spouse. ["grave-710699" by Siggy Nowak/Pixabay is in the public domain.]

One environmental stressor that has received much support in relation to MDD is stressful life events. In particular, severe stressful life events—those that have long-term consequences and involve loss of a significant relationship (e.g., divorce) or economic stability (e.g., unemployment) are strongly related to depression (Brown & Harris, 1989; Monroe et al., 2009). Stressful life events are more likely to predict the first MDE than subsequent episodes (Lewinsohn et al., 1999). In contrast, minor events may play a larger role in subsequent episodes than the initial episodes (Monroe & Harkness, 2005).

Depression research has not been limited to examining reactivity to stressful life events. Much research, particularly brain imaging research using functional magnetic resonance imaging (fMRI), has centered on examining neural circuitry—the interconnections that allow multiple brain regions to perceive, generate, and encode information in concert. A meta-analysis of neuroimaging studies showed that when viewing negative stimuli (e.g., picture of an angry face, picture of a car accident), compared with healthy control participants, participants with MDD have greater activation in brain regions involved in stress response and reduced activation of brain regions involved in positively motivated behaviors (Hamilton et al., 2012).

Other environmental factors related to increased risk for MDD include experiencing **early adversity** (e.g., childhood abuse or neglect) (Spatz Widom et al., 2007), **chronic stress** (e.g., poverty), and interpersonal factors. For example, marital dissatisfaction predicts increases in depressive symptoms in both men and women. On the other hand, depressive symptoms also predict increases in marital dissatisfaction (Whisman & Uebelacker, 2009). Research has found that people with MDD generate some of their interpersonal stress (Hammen, 2005). People with MDD whose relatives or spouses can be described as critical and emotionally overinvolved have higher relapse rates than do those living with people who are less critical and emotionally overinvolved (Butzlaff & Hooley, 1998).

People's **attributional styles** or their general ways of thinking, interpreting, and recalling information have also been examined in the etiology of MDD (Gotlib & Joorman, 2010). People with a pessimistic attributional style tend to make internal (versus external), global (versus specific), and stable (versus unstable) attributions to negative events, serving as a vulnerability to developing MDD. For example, someone who, when he fails an exam, thinks that it was his fault (internal), that he is stupid (global), and that he will always do poorly (stable) has a pessimistic attributional style. Several influential theories of depression incorporate attributional styles (Abramson et al., 1978, 1989).

Bipolar Disorders

Although there have been important advances in research on the etiology, course, and treatment of BD, there remains a need to understand the mechanisms that contribute to episode onset and relapse. There is compelling evidence for biological causes of BD, which is known to be highly heritable (McGuffin et al., 2003). It may be argued that a high rate of heritability demonstrates that BD is fundamentally a biological phenomenon. However, there is much variability in the course of BD both within a person across time and across people (Johnson, 2005). The triggers that determine how and when this genetic vulnerability is expressed are not yet understood; however, there is evidence to suggest that psychosocial triggers may play an important role in BD risk (e.g., Johnson et al., 2008; Malkoff-Schwartz et al., 1998).

In addition to the genetic contribution, biological explanations of BD have also focused on brain function. Many of the studies using fMRI techniques to characterize BD have focused on the processing of emotional stimuli based on the idea that BD is fundamentally a disorder of emotion (APA, 2000). Findings show that regions of the brain thought to be involved in emotional processing and regulation are activated differently in people with BD relative to healthy controls (e.g., Altshuler et al., 2008; Hassel et al., 2008; Lennox et al., 2004).

However, there is little consensus as to whether a particular brain region becomes more or less active in response to an emotional stimulus among people with BD compared with healthy controls. Mixed findings are in part due to samples consisting of participants who are at various phases of illness at the time of testing (manic, depressed, inter-episode). Sample sizes tend to be relatively small, making comparisons between subgroups difficult. Additionally, the use of a standardized stimulus (e.g., facial expression of anger) may

not elicit a sufficiently strong response. Personally engaging stimuli, such as recalling a memory, may be more effective in inducing strong emotions (Isaacowitz et al., 2013).

Within the psychosocial level, research has focused on the environmental contributors to BD. A series of studies shows that environmental stressors, particularly severe stressors (e.g., loss of a significant relationship), can adversely impact the course of BD. People with BD have substantially increased risk of relapse (Ellicott et al., 1990) and suffer more depressive symptoms (Johnson et al., 1999) following a severe life stressor. Interestingly, positive life events can also adversely impact the course of BD. People with BD suffer more manic symptoms after life events involving attainment of a desired goal (Johnson et al., 2008). Such findings suggest that people with BD may have a hypersensitivity to rewards.

Evidence from the life stress literature has also suggested that people with mood disorders may have a circadian vulnerability that renders them sensitive to stressors that disrupt their sleep or rhythms. According to **social zeitgeber theory** (Ehlers et al., 1988; Frank et al., 1994), stressors that disrupt sleep or that disrupt the daily routines that entrain the biological clock (e.g., meal times) can trigger episode relapse. Consistent with this theory, studies have shown that life events that involve a disruption in sleep and daily routines, such as overnight travel, can increase bipolar symptoms in people with BD (Malkoff-Schwartz et al., 1998).

WHAT ARE SOME OF THE WELL-SUPPORTED TREATMENTS FOR MOOD DISORDERS?

Depressive Disorders

There are many treatment options available for people with MDD. First, a number of antidepressant medications are available, all of which target one or more of the neurotransmitters implicated in depression. The earliest antidepressant medications were monoamine oxidase inhibitors (MAOIs). MAOIs inhibit monoamine oxidase, an enzyme involved in deactivating dopamine, norepinephrine, and serotonin. Although effective in treating depression, MAOIs can have serious side effects. Patients taking MAOIs may develop dangerously high blood pressure if they take certain drugs (e.g., antihistamines) or eat foods containing tyramine, an amino acid commonly found in foods such as aged cheeses, wine, and soy sauce. Tricyclics, the second-oldest class of antidepressant medications, block the reabsorption of norepinephrine, serotonin, or dopamine at synapses, resulting in their increased availability. Tricyclics are most effective for treating vegetative and somatic symptoms of depression. Like MAOIs, they have serious side effects, the most concerning of which is cardiotoxicity. Selective serotonin reuptake inhibitors (SSRIs; e.g., fluoxetine) and serotonin and norepinephrine reuptake inhibitors (SNRIs; e.g., duloxetine) are the most recently introduced antidepressant medications. SSRIs, the most commonly prescribed antidepressant medication, block the reabsorption of serotonin, whereas SNRIs block the reabsorption of serotonin and norepinephrine. SSRIs and SNRIs have fewer serious side effects than do MAOIs and tricyclics. In particular, they are less cardiotoxic, less lethal in overdose, and produce fewer cognitive impairments. They are not, however, without their own side effects, which include but are not limited to difficulty having orgasms, gastrointestinal issues, and insomnia. It should be noted that antidepressant medication may not work equally for all people. This approach to treatment often involves experimentation with several medications and dosages, and may be more effective when paired with physical exercise and psychotherapy.

Other biological treatments for people with depression include electroconvulsive therapy (ECT), transcranial magnetic stimulation (TMS), and deep brain stimulation. ECT involves inducing a seizure after a patient takes muscle relaxants and is under general anesthesia. ECT is a viable treatment for patients with severe depression or who show resistance to antidepressants although the mechanisms through which it works remain unknown. A common side effect is confusion and memory loss, usually short-term (Schulze-Rauschenbach et al., 2005). Repetitive TMS is a noninvasive technique administered while a patient is awake. Brief pulsating magnetic fields are delivered to the cortex, inducing electrical activity. TMS has fewer side effects than ECT (Schulze-Rauschenbach et al., 2005), and while outcome studies are mixed, there is evidence that TMS is a promising treatment for patients with MDD who have shown resistance to other treatments (Rosa et al., 2006). Most recently, deep brain stimulation is being examined as a treatment option for patients

A number of medications are effective in treating mood disorders. Meditation, exercise, counseling, and other therapies also show effectiveness for some disorders. ["Photo Of Woman Meditating" by Natalie/Pexels is in the public domain.]

who do not respond to more traditional treatments like those already described. Deep brain stimulation involves implanting an electrode in the brain. The electrode is connected to an implanted neurostimulator, which electrically stimulates that particular brain region. Although there is some evidence of its effectiveness (Mayberg et al., 2005), additional research is needed.

Several psychosocial treatments have received strong empirical support, meaning that independent investigations have achieved similarly positive results—a high threshold for examining treatment outcomes. These treatments include but are not limited to behavior therapy, cognitive therapy, and interpersonal therapy. Behavior therapies focus on increasing the frequency and quality of experiences that are pleasant or help the patient achieve mastery. Cognitive therapies primarily focus on helping patients identify and change distorted automatic thoughts and assumptions (e.g., Beck, 1967). Cognitive-behavioral therapies are based on the rationale that thoughts, behaviors, and emotions affect and are affected by each other. Interpersonal therapy for depression focuses largely on improving interpersonal relationships by targeting problem areas, specifically unresolved grief, interpersonal role disputes, role transitions, and interpersonal deficits. Finally, there is also some support for the effectiveness of short-term psychodynamic therapy for depression (Leichsenring, 2001). The short-term treatment focuses on a limited number of important issues, and the therapist tends to be more actively involved than in more traditional psychodynamic therapy.

Bipolar Disorders

Patients with BD are typically treated with pharmacotherapy. Antidepressants such as SSRIs and SNRIs are the primary choice of treatment for depression, whereas for BD, lithium is the first-line treatment choice. This is because SSRIs and SNRIs have the potential to induce mania or hypomania in patients with BD. Lithium acts on several neurotransmitter systems in the brain through complex mechanisms, including reduction of excitatory (dopamine and glutamate) neurotransmission, and increasing of inhibitory (GABA) neurotransmission (Lenox & Hahn, 2000). Lithium has strong efficacy for the treatment of BD (Geddes et al., 2004). However, a number of side effects can make lithium treatment difficult for patients to tolerate. Side effects include impaired cognitive function (Wingo et al., 2009), as well as physical symptoms such as nausea, tremor, weight gain, and fatigue (Dunner, 2000). Some of these side effects can improve with continued use; however, medication noncompliance remains an ongoing concern in the treatment of patients with BD. Anticonvulsant medications (e.g., carbamazepine, valproate) are also commonly used to treat patients with BD, either alone or in conjunction with lithium.

There are several adjunctive treatment options for people with BD. Interpersonal and social rhythm therapy (IPSRT) (Frank et al., 1994) is a psychosocial intervention focused on addressing the mechanism of action posited in social zeitgeber theory to predispose patients who have BD to relapse, namely sleep disruption. A growing body of literature provides support for the central role of sleep dysregulation in BD (Harvey, 2008). Consistent with this literature, IPSRT aims to increase rhythmicity of patients' lives and encourage vigilance in maintaining a stable rhythm. The therapist and patient work to develop and maintain a healthy balance of activity and stimulation such that the patient does not become overly active (e.g., by taking on too many projects) or inactive (e.g., by avoiding social contact). The efficacy of IPSRT has been demonstrated in that patients who received this treatment show reduced risk of episode recurrence and are more likely to remain well (Frank et al., 2005).

CONCLUSION

Everyone feels down or euphoric from time to time. For some people, these feelings can last for long periods of time and can also co-occur with other symptoms that, in combination, interfere with their everyday lives. When people experience an MDE or a manic episode, they see the world differently. During an MDE, people often feel hopeless about the future and may even experience suicidal thoughts. During a manic episode, people often behave in ways that are risky or place them in danger. They may spend money excessively or have unprotected sex, often expressing deep shame over these decisions after the episode. MDD and BD cause significant problems for people at school, at work, and in their relationships and affect people regardless of gender, age, nationality, race, religion, or sexual orientation. If you or someone you know is suffering from a mood disorder, it is important to seek help. Effective treatments are available and continually improving. If you have an interest in mood disorders, there are many ways to contribute to their understanding, prevention, and treatment, whether by engaging in research or clinical work.

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READING 36

Schizophrenia Spectrum Disorders

Deanna M. Barch

SOURCE

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LEARNING OBJECTIVES

- Describe the signs and symptoms of schizophrenia and related psychotic disorders.
- Describe the most well-replicated cognitive and neurobiological changes associated with schizophrenia.
- Describe the potential risk factors for the development of schizophrenia.
- Describe the controversies associated with "clinical high risk" approaches to identifying individuals at risk for the development of schizophrenia.
- Describe the treatments that work for some of the symptoms of schizophrenia.

KEY TERMS

alogia
amotivation
anhedonia
catatonia
delusions
diagnostic criteria
disorganized behavior
disorganized speech
dopamine
episodic memory
flat affect
functional capacity
hallucinations
magnetic resonance imaging
neurodevelopmental factors
positron emission tomography
processing speed
psychopathology
working memory

Schizophrenia and the other psychotic disorders are some of the most impairing forms of psychopathology, frequently associated with a profound negative effect on the individual's educational, occupational, and social function. Sadly, these disorders often manifest right at the time of transition from adolescence to adulthood, just as young people should be evolving into independent young adults. The spectrum of psychotic disorders includes schizophrenia, schizoaffective disorder, delusional disorder, schizotypal personality disorder, schizophreniform disorder, brief psychotic disorder, and psychosis associated with substance use or medical conditions. In this module, we summarize the primary clinical features of these disorders, describe the known cognitive and neurobiological changes associated with schizophrenia, describe potential risk factors and/or causes for the development of schizophrenia, and describe currently available treatments for schizophrenia.

THE PHENOMENOLOGY OF SCHIZOPHRENIA AND RELATED PSYCHOTIC DISORDERS

Most of you have probably had the experience of walking down the street in a city and seeing a person you thought was acting oddly. They may have been dressed in an unusual way, perhaps disheveled or wearing an unusual collection of clothes, makeup, or jewelry that did not seem to fit any particular group or subculture. They may have been talking to themselves or yelling at someone you could not see. If you tried to speak to them, they may have been difficult to follow or understand, or they may have acted paranoid or started telling a bizarre story about the people who were plotting against them. If so, chances are that you have encountered an individual with schizophrenia or another type of psychotic disorder. If you have watched the movie *A Beautiful Mind* or *The Fisher King*, you have also seen a portrayal of someone thought to have schizophrenia. Sadly, a few of the individuals who have committed some of the recently highly publicized mass murders may have had schizophrenia, though most people who commit such crimes do not have schizophrenia. It is also likely that you have met people with schizophrenia without ever knowing it, as they may suffer in silence or stay isolated to protect themselves from the horrors they see, hear, or believe are operating in the outside world. As these examples begin to illustrate, psychotic disorders involve many different types of symptoms, including delusions, hallucinations, disorganized speech and behavior, abnormal motor behavior (including catatonia),

and negative symptoms such anhedonia or amotivation and blunted affect/reduced speech.

Delusions are false beliefs that are often fixed, hard to change even when the person is presented with conflicting information, and often culturally influenced in their content (e.g., delusions involving Jesus in Judeo-Christian cultures, delusions involving Allah in Muslim cultures). They can be terrifying for the person, who may remain convinced that they are true even when loved ones and friends present them with clear information that they cannot be true. There are many different types or themes to delusions.

The most common delusions are persecutory and involve the belief that individuals or groups are trying to harm or plot against the person in some way. These can be people that the person knows (people at work, the neighbors, family members), or more abstract groups (the FBI, the CIA, aliens, etc.). Other types of delusions include grandiose delusions, where the person believes they have some special power or ability (e.g., I am the new Buddha, I am a rock star); referential delusions, where the person believes that events or objects in the environment have special meaning for them (e.g., that song on the radio is being played *specifically* for me); or other types of delusions where the person may believe that others are controlling their thoughts and actions, that their thoughts are being broadcast aloud, or that others can read their mind (or they can read other people's minds).

When you see a person on the street talking to themselves or shouting at other people, they are experiencing **hallucinations**. These are perceptual experiences that occur even when there is no stimulus in the outside world generating the experiences. They can be auditory, visual, olfactory (smell), gustatory (taste), or somatic (touch). The most common hallucinations in psychosis (at least in adults) are auditory and

Under surveillance: Abstract groups like the police or the government are commonly the focus of persecutory delusions in a person with schizophrenia. ["W beauty" by Thomas Hawk/Flickr is licensed under CC BY-NC 2.0.]

People who suffer from schizophrenia may see the world differently. This can include hallucinations, delusions, and disorganized thinking. [Untitled image by Noba Project is licensed under CC BY-NC-SA 4.0.]

can involve one or more voices talking about the person, commenting on the person's behavior, or giving them orders. The content of the hallucinations is frequently negative ("you are a loser," "that drawing is stupid," "you should go kill yourself") and can be the voice of someone the person knows or a complete stranger. Sometimes the voices sound as if they are coming from outside the person's head. Other times the voices seem to be coming from inside the person's head, but are not experienced the same as the person's inner thoughts or inner speech.

Talking to someone with schizophrenia is sometimes difficult, as their speech may be difficult to follow, either because their answers do not clearly flow from your questions, or because one sentence does not logically follow from another. This is referred to as **disorganized speech**, and it can be present even when the person is writing. **Disorganized behavior** can include odd dress, odd makeup (e.g., lipstick outlining a mouth for 1 inch), or unusual rituals (e.g., repetitive hand gestures). Abnormal motor behavior can include **catatonia**, which refers to a variety of behaviors that seem to reflect a reduction in responsiveness to the external environment. This can include holding unusual postures for long periods of time, failing to respond to verbal or motor prompts from another person, or excessive and seemingly purposeless motor activity.

Some of the most debilitating symptoms of schizophrenia are difficult for others to see. These include what people refer to as "negative symptoms" or the absence of certain things we typically expect most people to have. For example, **anhedonia** and **amotivation** reflect a lack of apparent interest in or drive to engage in social or recreational activities. These symptoms can manifest as a great amount of time spent in physical immobility. Importantly, anhedonia and amotivation do not seem to reflect a lack of enjoyment in pleasurable activities or events (Cohen & Minor, 2010; Kring & Moran,

2008; Llerena et al., 2012) but rather a reduced drive or ability to take the steps necessary to obtain the potentially positive outcomes (Barch & Dowd, 2010). **Flat affect** and reduced speech (**alogia**) reflect a lack of showing emotions through facial expressions, gestures, and speech intonation, as well as a reduced amount of speech and increased pause frequency and duration.

In many ways, the types of symptoms associated with psychosis are the most difficult for us to understand, as they may seem far outside the range of our normal experiences. Unlike depression or anxiety, many of us may not have had experiences that we think of as on the same continuum as psychosis. However, just like many of the other forms of **psychopathology** described in this book, the types of psychotic symptoms that characterize disorders like schizophrenia are on a continuum with "normal" mental experiences. For example, work by Jim van Os in the Netherlands has shown that a surprisingly large percentage of the general population (10%+) experience psychotic-like symptoms, though many fewer have multiple experiences and most will not continue to experience these symptoms in the long run (Verdoux & van Os, 2002). Similarly, work in a general population of adolescents and young adults in Kenya has also shown that a relatively high percentage of individuals experience one or more psychotic-like experiences (~19%) at some point in their lives (Mamah et al., 2012; Ndetei et al., 2012), although again most will not go on to develop a full-blown psychotic disorder.

Schizophrenia is the primary disorder that comes to mind when we discuss "psychotic" disorders (see **TABLE 36.1** for **diagnostic criteria**), though there are a number of other disorders that share one or more features with schizophrenia. In the remainder of this module, we will use the terms "psychosis" and "schizophrenia" somewhat interchangeably, given that most of the research has focused on schizophrenia. In addition to schizophrenia (see **TABLE 36.1**), other psychotic disorders include schizophreniform disorder (a briefer version of schizophrenia), schizoaffective disorder (a mixture of psychosis and depression/mania symptoms), delusional disorder (the experience of only delusions), and brief psychotic disorder (psychotic symptoms that last only a few days or weeks).

TABLE 36.1. Types of Psychotic Disorders

Schizophrenia (lifetime prevalence about 0.3% to 0.7%)
- Two or more of the following for at least 1 month: hallucinations, delusions, disorganized speech, grossly disorganized or catatonic behavior, negative symptoms.
- Impairment in one or more areas of function (social, occupational, educational self-care) for a significant period of time since the onset of the illness.
- Continuous signs of the illness for at least 6 months (this can include prodromal or residual symptoms, which are attenuated forms of the symptoms described above).

Schizophreniform Disorder (lifetime prevalence similar to Schizophrenia)
- The same symptoms of schizophrenia described above that are present for at least 1 month but less than 6 months.

Schizoaffective Disorder (lifetime prevalence above 0.3%)
- A period of illness where the person has both the psychotic symptoms necessary to meet criteria for schizophrenia and either a major depression or manic episode.
- The person experiences either delusions or hallucinations for at least 2 weeks when they are not having a depressive or manic episode.
- The symptoms that meet criteria for depressive or manic episodes are present for over half of the illness duration.

Delusional Disorder (lifetime prevalence about 0.2%)
- The presence of at least one delusion for at least a month.
- The person has never met criteria for schizophrenia.
- The person's function is not impaired outside the specific impact of the delusion.
- The duration of any depressive or manic episodes have been brief relative to the duration of the delusion(s).

Brief Psychotic Disorder (lifetime prevalence unclear)
- One or more of the following symptoms present for at least 1 day but less than 1 month: delusions, hallucinations, disorganized speech, grossly disordered or catatonic behavior.

Attenuated Psychotic Disorder (in Section III of the *DSM-5*, lifetime prevalence unclear)
- One or more of the following symptoms in an "attenuated" form: delusions, hallucinations, or disorganized speech.
- The symptoms must have occurred at least once a week for the past month and must have started or gotten worse in the past year.
- The symptoms must be severe enough to distress or disable the individual or to suggest to others that the person needs clinical help.
- The person has never met the diagnostic criteria for a psychotic disorder, and the symptoms are not better attributed to another disorder, to substance use, or to a medical condition.

Simplified from the *Diagnostic and Statistical Manual*, 5th edition *(DSM-5)* (American Psychiatric Association [APA], 2013)

THE COGNITIVE NEUROSCIENCE OF SCHIZOPHRENIA

As described above, when we think of the core symptoms of psychotic disorders such as schizophrenia, we think of people who hear voices, see visions, and have false beliefs about reality (i.e., delusions). However, problems in cognitive function are also a critical aspect of psychotic disorders and of schizophrenia in particular. This emphasis on cognition in schizophrenia is in part due to the growing body of research suggesting that cognitive problems in schizophrenia are a major source of disability and loss of **functional capacity** (Green, 2006; Nuechterlein et al., 2011). The cognitive deficits that are present in schizophrenia are widespread and can include problems with **episodic memory** (the ability to learn and retrieve new information or episodes in one's life), **working memory** (the ability to maintain information over a short period of time, such as 30 seconds), and other tasks that require one to "control" or regulate one's behavior (Barch & Ceaser, 2012; Bora et al., 2009a; Fioravanti et al., 2005; Forbes et al., 2009; Mesholam-Gately et al., 2009). Individuals with schizophrenia also have difficulty with what is referred to as "**processing speed**" and are frequently slower than healthy individuals on almost all tasks. Importantly, these cognitive deficits are present prior to the onset of the illness (Fusar-Poli et al., 2007) and are also present, albeit in a milder form, in the first-degree relatives of people with schizophrenia (Snitz et al., 2006). This suggests that cognitive impairments in schizophrenia reflect part of the risk for the development of psychosis, rather than being an outcome of developing psychosis. Furthermore, people with schizophrenia who have more severe cognitive problems also tend to have more severe negative symptoms and more disorganized speech and behavior (Barch et al., 1999, 2003; de Gracia Dominguez et al., 2009; Ventura et al., 2009, 2010). In addition, people with more cognitive problems have worse function in everyday life (Bowie et al., 2006, 2008; Fett et al., 2011).

Some people with schizophrenia suffer from difficulty with social cognition. They may not be able to detect the meaning of facial expressions or other subtle cues that most other people rely on to navigate the social world. ["the mask" by wolfgangfoto/Flickr is licensed under CC BY-ND 2.0.]

Some people with schizophrenia also show deficits in what is referred to as social cognition, though it is not clear whether such problems are separate from the cognitive problems described above or the result of them (Hoe et al., 2012; Kerr & Neale, 1993; van Hooren et al., 2008). This includes problems with the recognition of emotional expressions on the faces of other individuals (Kohler et al., 2010) and problems inferring the intentions of other people (theory of mind) (Bora et al., 2009b).

Individuals with schizophrenia who have more problems with social cognition also tend to have more negative and disorganized symptoms (Ventura et al., 2011), as well as worse community function (Fett et al., 2011).

The advent of neuroimaging techniques such as structural and functional **magnetic resonance imaging** and **positron emission tomography** opened up the ability to try to understand the brain mechanisms of the symptoms of schizophrenia as well as the cognitive impairments found in psychosis. For example, a number of studies have suggested that delusions in psychosis may be associated with problems in "salience" detection mechanisms supported by the ventral striatum (Jensen & Kapur, 2009; Jensen et al., 2008; Kapur, 2003, Kapur et al., 2005; Murray et al., 2008) and the anterior prefrontal cortex (Corlett, Honey, et al., 2006; Corlett, Honey, & Fletcher, 2007; Corlett, Murray, et al., 2007). These are regions of the brain that normally increase their activity when something important (aka "salient") happens in the environment. If these brain regions misfire, it may lead individuals with psychosis to mistakenly attribute importance to irrelevant or unconnected events. Furthermore, there is good evidence that problems in working memory and cognitive control in schizophrenia are related to problems in the function of a region of the brain called the dorsolateral prefrontal cortex (DLPFC) (Minzenberg et al., 2009; Ragland et al., 2009). These problems include changes in how the DLPFC works when people are doing working-memory or cognitive-control tasks, and how this brain region is connected to other brain regions important for working memory and cognitive control, including the posterior parietal cortex (e.g., Karlsgodt et al., 2008; Kim et al., 2003; Schlösser et al., 2003), the anterior cingulate (Repovš & Barch, 2012), and temporal cortex (e.g., Fletcher et al., 1995; Meyer-Lindenberg et al., 2001). In terms of understanding episodic memory problems in schizophrenia, many researchers have focused on medial temporal lobe deficits, with a specific focus on the hippocampus (e.g., Heckers & Konradi, 2010). This is because there is

much data from humans and animals showing that the hippocampus is important for the creation of new memories (Squire, 1992). However, it has become increasingly clear that problems with the DLPFC also make important contributions to episodic memory deficits in schizophrenia (Ragland et al., 2009), probably because this part of the brain is important for controlling our use of memory.

In addition to problems with regions such as the DLFPC and medial temporal lobes in schizophrenia described above, magnitude resonance neuroimaging studies have also identified changes in cellular architecture, white matter connectivity, and gray matter volume in a variety of regions that include the prefrontal and temporal cortices (Bora et al., 2011). People with schizophrenia also show reduced overall brain volume, and reductions in brain volume as people get older may be larger in those with schizophrenia than in healthy people (Olabi et al., 2011). Taking antipsychotic medications or taking drugs such as marijuana, alcohol, and tobacco may cause some of these structural changes. However, these structural changes are not completely explained by medications or substance use alone. Furthermore, both functional and structural brain changes are seen, again to a milder degree, in the first-degree relatives of people with schizophrenia (Boos et al., 2007; Brans et al., 2008; Fusar-Poli et al., 2007; MacDonald et al., 2009). This again suggests that neural changes associated with schizophrenia are related to a genetic risk for this illness.

RISK FACTORS FOR DEVELOPING SCHIZOPHRENIA

It is clear that there are important genetic contributions to the likelihood that someone will develop schizophrenia, with consistent evidence from family, twin, and adoption studies. (Sullivan et al., 2003). However, there is no "schizophrenia gene," and it is likely that the genetic risk for schizophrenia reflects the summation of many different genes that each contribute something to the likelihood of developing psychosis (Gottesman & Shields, 1967; Owen et al., 2010). Further, schizophrenia is a very heterogeneous disorder, which means that two different people with "schizophrenia" may each have very different symptoms (e.g., one has hallucinations and delusions, the other has disorganized speech and negative symptoms). This makes it even more challenging to identify specific genes associated with risk for psychosis. Importantly, many studies also now suggest that at least some of the genes potentially associated with schizophrenia are also associated with other mental health conditions, including bipolar disorder, depression, and autism (Gejman et al., 2011; Kim et al., 2011; Owen et al., 2010; Rutter et al., 2006).

There are also a number of environmental factors that are associated with an increased risk of developing schizophrenia. For example, problems during pregnancy, such as

There are a number of genetic and environmental risk factors associated with higher likelihood of developing schizophrenia, including older fathers, complications during pregnancy/delivery, family history of schizophrenia, and growing up in an urban environment. ["back-to-school-939922" by Veronica Martinez/Pixabay is in the public domain.]

increased stress, infection, malnutrition, and/or diabetes, have been associated with increased risk of schizophrenia. In addition, complications that occur at the time of birth and that cause hypoxia (lack of oxygen) are also associated with an increased risk for developing schizophrenia (Cannon et al., 2002; Miller et al., 2011). Children born to older fathers are also at a somewhat increased risk of developing schizophrenia. Furthermore, using cannabis increases risk for developing psychosis, especially if one has other risk factors (Casadio et al., 2011; Luzi et al., 2008). The likelihood of developing schizophrenia is also higher for children who grow up in urban settings (March et al., 2008) and for some minority ethnic groups (Bourque et al., 2011). Both of these factors may reflect higher social and environmental stress in these settings. Unfortunately, none of these risk factors is specific enough to be particularly useful in a clinical setting, and most people with these "risk" factors do not develop schizophrenia. However, together they are beginning to give us clues as the **neurodevelopmental factors** that may lead someone to be at an increased risk for developing this disease.

An important research area on risk for psychosis has been work with individuals who may be at "clinical high risk." These are individuals who are showing attenuated (milder) symptoms of psychosis that have developed recently and who are experiencing some distress or disability associated with these symptoms. When people with these types of symptoms are followed over time, about 35% of them develop a psychotic disorder (Cannon et al., 2008), most frequently schizophrenia (Fusar-Poli et al., 2012). In order to identify these individuals, a new category of diagnosis, called "Attenuated Psychotic Syndrome," was added to Section III (the section for disorders in need of

further study) of the *DSM-5* (see **TABLE 36.1** for symptoms) (American Psychiatric Association [APA], 2013). However, adding this diagnostic category to the *DSM-5* created a good deal of controversy (Batstra & Frances, 2012; Fusar-Poli & Yung, 2012). Many scientists and clinicians have been worried that including "risk" states in the *DSM-5* would create mental disorders where none exist, that these individuals are often already seeking treatment for other problems, and that it is not clear that we have good treatments to stop these individuals from developing psychosis. However, the counterarguments have been that there is evidence that individuals with high-risk symptoms develop psychosis at a much higher rate than individuals with other types of psychiatric symptoms and that the inclusion of Attenuated Psychotic Syndrome in Section III will spur important research that might have clinical benefits. Further, there is some evidence that non-invasive treatments such as omega-3 fatty acids and intensive family intervention may help reduce the development of full-blown psychosis (Preti & Cella, 2010) in people who have high-risk symptoms.

TREATMENT OF SCHIZOPHRENIA

The currently available treatments for schizophrenia leave much to be desired, and the search for more effective treatments for both the psychotic symptoms of schizophrenia (e.g., hallucinations and delusions) as well as cognitive deficits and negative symptoms is a highly active area of research. The first line of treatment for schizophrenia and other psychotic disorders is the use of antipsychotic medications. There are two primary types of antipsychotic medications, referred to as "typical" and "atypical." The fact that "typical" antipsychotics helped some symptoms of schizophrenia was discovered serendipitously more than 60 years ago (Carpenter & Davis, 2012; López-Muñoz et al., 2005). These are drugs that all share a common feature of being a strong block of the D2 type **dopamine** receptor. Although these drugs can help reduce hallucinations, delusions, and disorganized speech, they do little to improve cognitive deficits or negative symptoms and can be associated with distressing motor side effects. The newer generation of antipsychotics is referred to as "atypical" antipsychotics. These drugs have more mixed mechanisms of action in terms of the receptor types that they influence, though most of them also influence D2 receptors. These newer antipsychotics are not necessarily more helpful for schizophrenia but have fewer motor side effects. However, many of the atypical antipsychotics are associated with side effects referred to as the "metabolic syndrome," which includes weight gain and increased risk for cardiovascular illness, type 2 diabetes, and mortality (Lieberman et al., 2005).

The evidence that cognitive deficits also contribute to functional impairment in schizophrenia has led to an increased search for treatments that might enhance cognitive function in schizophrenia. Unfortunately, as of yet, there are no pharmacological treatments that work consistently to improve cognition in schizophrenia, although many new types of drugs are currently under exploration. However, there is a type of psychological intervention, referred to as cognitive remediation, that has shown some evidence of helping cognition and function in schizophrenia. In particular, a version of this treatment called cognitive enhancement therapy (CET) has been shown to improve cognition, functional outcome, and social cognition and to protect against gray matter loss (Eack et al., 2009; Eack, Greenwald, et al., 2010; Eack, Hogarty, et al., 2010; Eack et al., 2011; Hogarty et al., 2006) in young individuals with schizophrenia. The development of new treatments such as cognitive enhancement therapy provides some hope that we will be able to develop new and better approaches to improving the lives of individuals with this serious mental health condition and potentially even prevent it some day.

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READING 37

Personality Disorders

Cristina Crego and Thomas Widiger

SOURCE

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LEARNING OBJECTIVES

- Define what is meant by a personality disorder.
- Identify the five domains of general personality.
- Identify the six personality disorders proposed for retention in *DSM-5*.
- Summarize the etiology for antisocial and borderline personality disorder.
- Identify the treatment for borderline personality disorder.

KEY TERMS

antisocial
avoidant
borderline
dependent
Five-Factor Model
histrionic
narcissistic
obsessive-compulsive
paranoid
personality
personality disorders
schizoid
schizotypal

The purpose of this module is to define what is meant by a personality disorder, identify the five domains of general personality, identify the six personality disorders proposed for retention in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)*, summarize the etiology for antisocial and borderline personality disorder, and identify the treatment for borderline personality disorder.

INTRODUCTION

Everybody has their own unique **personality**; that is, their characteristic manner of thinking, feeling, behaving, and relating to others (John, Robins & Pervin, 2008). Some people are typically introverted, quiet, and withdrawn, whereas others are more extraverted, active, and outgoing. Some individuals are invariably conscientiousness, dutiful, and efficient, whereas others might be characteristically undependable and negligent. Some individuals are consistently anxious, self-conscious, and apprehensive, whereas others are routinely relaxed, self-assured, and unconcerned. Personality traits refer to these characteristic, routine ways of thinking, feeling, and relating to others. There are signs or indicators of these traits in childhood, but they become particularly evident when the person is an adult. Personality traits are integral to each person's sense of self, as they involve what people value, how they think and feel about things, what they like to do, and, basically, what they are like most every day throughout much of their lives.

There are literally hundreds of different personality traits. All of these traits can be organized into the broad dimensions referred to as the **Five-Factor Model** (John, Naumann, & Soto, 2008). These five broad domains are inclusive; there do not appear to be any traits of personality that lie outside of the Five-Factor Model. This even applies to traits that you may use to describe yourself. **TABLE 37.1** provides illustrative traits for both poles of the five domains of this model of personality. A number of the traits that you see in this table may describe you. If you can think of some other traits that describe yourself, you should be able to place them somewhere in this table.

DSM-5 PERSONALITY DISORDERS

When personality traits result in significant distress, social impairment, and/or occupational impairment, they are considered to be a personality disorder (American Psychiatric Association [APA], 2013). The authoritative manual for what constitutes a personality disorder is provided by the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders (DSM)*, the current version of which is *DSM-5* (APA, 2013). The *DSM* provides a common language and standard criteria for the classification and diagnosis of mental disorders. This manual is used by clinicians, researchers, health insurance companies, and policymakers. *DSM-5* includes ten **personality disorders**: antisocial, avoidant, borderline, dependent, histrionic, narcissistic, obsessive-compulsive, paranoid, schizoid, and schizotypal.

TABLE 37.1. Illustrative Traits for Both Poles across Five-Factor Model Personality Dimensions

Neuroticism (Emotional Instability) Fearful, apprehensive, angry, bitter, pessimistic, glum, timid, embarrassed, tempted, urgent, helpless, fragile	**vs.**	**Emotional Stability** Relaxed, unconcerned, cool, even-tempered, optimistic, self-assured, glib, shameless, controlled, restrained, clear-thinking, fearless, unflappable
Extraversion Cordial, affectionate, attached, sociable, outgoing, dominant, forceful, vigorous, energetic, active, reckless, daring, high-spirited, excitement-seeking	**vs.**	**Introversion** Cold, aloof, indifferent, withdrawn, isolated, unassuming, quiet, resigned, passive, lethargic, cautious, monotonous, dull, placid, anhedonic
Openness (Unconventionality) Dreamer, unrealistic, imaginative, aberrant, aesthetic, self-aware, eccentric, strange, odd, peculiar, creative, permissive, broad-minded	**vs.**	**Closedness (Conventionality)** Practical, concrete, uninvolved, no aesthetic interest, constricted, unaware, alexythymic, routine, predictable, habitual, stubborn, pragmatic, rigid, traditional, inflexible, dogmatic
Agreeableness Gullible, naive, trusting, confiding, honest, sacrificial, giving, docile, cooperative, meek, self-effacing, humble, soft, empathetic	**vs.**	**Antagonism** Skeptical, cynical, suspicious, paranoid, cunning, manipulative, deceptive, stingy, selfish, greedy, exploitative, oppositional, combative, aggressive, confident, boastful, arrogant, tough, callous, ruthless
Conscientiousness Perfectionistic, efficient, ordered, methodical, organized, rigid, reliable, dependable, workaholic, ambitious, dogged, devoted, cautious, ruminative, reflective	**vs.**	**Disinhibition** Lax, negligent, haphazard, disorganized, sloppy, casual, undependable, unethical, aimless, desultory, hedonistic, negligent, hasty, careless, rash

This list of ten, though, does not fully cover all of the different ways in which a personality can be maladaptive. *DSM-5* also includes a "wastebasket" diagnosis of other specified personality disorder (OSPD) and unspecified personality disorder (UPD). This diagnosis is used when a clinician believes that a patient has a personality disorder but the traits that constitute this disorder are not well covered by one of the ten existing diagnoses. OSPD and UPD—or, as they used to be referred to in previous editions, PDNOS (personality disorder not otherwise specified)—are often one of the most frequently used diagnoses in clinical practice, suggesting that the current list of ten is not adequately comprehensive (Widiger & Trull, 2007).

DESCRIPTION

Each of the ten *DSM-5* (and *DSM-IV-TR*) personality disorders is a constellation of maladaptive personality traits, rather than just one particular personality trait (Lynam & Widiger, 2001). In this regard, personality disorders are "syndromes." For example, **avoidant** personality disorder is a pervasive pattern of social inhibition, feelings of inadequacy, and hypersensitivity to negative evaluation (APA, 2013), which is a combination of traits from introversion (e.g., socially withdrawn, passive, and cautious) and neuroticism (e.g., self-conscious, apprehensive, anxious, and worrisome). **Dependent** personality disorder includes submissiveness, clinging behavior, and fears of separation (APA, 2013), for the most part a combination of traits of neuroticism (anxious, uncertain, pessimistic, and helpless) and maladaptive agreeableness (e.g., gullible, guileless, meek, subservient, and self-effacing). **Antisocial** personality disorder is, for the most part, a combination of traits from antagonism (e.g., dishonest, manipulative, exploitative, callous, and merciless) and low conscientiousness (e.g., irresponsible, immoral, lax, hedonistic, and rash). See the 1967 movie, *Bonnie and Clyde*, starring Warren Beatty, for a nice portrayal of someone with antisocial personality disorder.

Some of the *DSM-5* personality disorders are confined largely to traits within one of the basic domains of personality. For example, **obsessive-compulsive** personality disorder is largely a disorder of maladaptive conscientiousness (e.g., workaholic, perfectionistic, punctilious, ruminative, and dogged); **schizoid** is confined largely to traits of introversion (e.g., withdrawn, cold, isolated, placid, and anhedonic); **borderline** personality disorder is largely a disorder of neuroticism (e.g., emotionally unstable, vulnerable, overwhelmed, rageful, depressive, and self-destructive; watch the 1987 movie, *Fatal Attraction*, starring Glenn Close, for a nice portrayal of this personality disorder); and **histrionic** personality disorder is largely a disorder of maladaptive extraversion, including such traits as attention-seeking, seductiveness, melodramatic emotionality, and strong attachment needs (see the 1951 film adaptation of Tennessee Williams's play, *A Streetcar Named Desire,* starring Vivian Leigh, for a nice portrayal of this personality disorder).

A person with obsessive compulsive personality disorder may have a hard time relaxing, always feel under pressure, and believe that there isn't enough time to accomplish important tasks. ["315644" by Pixabay/Pexels is in the public domain.]

It should be noted though that a complete description of each *DSM-5* personality disorder would typically include at least some traits from other domains. For example, antisocial personality disorder (or psychopathy) also includes some traits from low neuroticism (e.g., fearlessness and glib charm) and extraversion (e.g., excitement-seeking and assertiveness); borderline includes some traits from antagonism (e.g., manipulativeness and opposition) and low conscientiousness (e.g., rashness); and histrionic includes some traits from antagonism (e.g., vanity) and low conscientiousness (e.g., impressionism). **Narcissistic** personality disorder includes traits from neuroticism (e.g., reactive anger, reactive shame, and need for admiration), extraversion (e.g., exhibitionism and authoritativeness), antagonism (e.g., arrogance, entitlement, and lack of empathy), and conscientiousness (e.g., acclaim-seeking). **Schizotypal** personality disorder includes traits from neuroticism (e.g., social anxiousness and social discomfort), introversion (e.g., social withdrawal), unconventionality (e.g., oddness, eccentricity, peculiarity, and aberrant ideas), and antagonism (e.g., suspiciousness).

The APA currently conceptualizes personality disorders as qualitatively distinct conditions; distinct from each other and from normal personality functioning. However, included within an appendix to *DSM-5* is an alternative view that personality disorders are simply extreme and/or maladaptive variants of normal personality traits, as suggested herein. Nevertheless, many leading personality disorder researchers do not hold this view (e.g., Gunderson, 2010; Hopwood, 2011; Shedler et al., 2010). They suggest that there is something qualitatively unique about persons suffering from a personality disorder, usually understood as a form of pathology in sense of self and interpersonal relatedness that is considered to be distinct from personality traits (APA, 2012; Skodol, 2012). For example, it has been suggested that antisocial personality disorder includes impairments in identity (e.g., egocentrism), self-direction, empathy, and capacity for intimacy, which are said to be different from such traits as arrogance, impulsivity, and callousness (APA, 2012).

VALIDITY

It is quite possible that in future revisions of the *DSM* some of the personality disorders included in *DSM-5* and *DSM-IV-TR* will no longer be included. In fact, for *DSM-5* it was originally proposed that four be deleted. The personality disorders that were slated for deletion were histrionic, schizoid, **paranoid**, and dependent (APA, 2012). The rationale for the proposed deletions was in large part because they are said to have less empirical support than the diagnoses that were at the time being retained (Skodol, 2012). There is agreement within the field with regard to the empirical support for the borderline, antisocial, and schizotypal personality disorders (Mullins-Sweatt et al., 2012; Skodol, 2012). However, there is a difference of opinion with respect to the empirical support for the dependent personality disorder (Bornstein, 2012; Livesley, 2011; Miller et al., 2010; Mullins-Sweatt et al., 2012).

Little is known about the specific etiology for most of the *DSM-5* personality disorders. Because each personality disorder represents a constellation of personality traits, the etiology for the syndrome will involve a complex interaction of an array of different neurobiological vulnerabilities and dispositions with a variety of environmental, psychosocial events. Antisocial personality disorder, for instance, is generally considered to be the result of an interaction of genetic dispositions for low anxiousness, aggressiveness, impulsivity, and/or callousness, with a tough, urban environment, inconsistent parenting, poor parental role modeling, and/or peer support (Hare et al., 2012). Borderline personality disorder is generally considered to be the result of an interaction of a genetic disposition to negative affectivity interacting with a malevolent, abusive, and/or invalidating family environment (Hooley et al., 2012).

To the extent that one considers the *DSM-5* personality disorders to be maladaptive variants of general personality structure, as described, for instance, within the Five-Factor Model, there would be a considerable body of research to support the validity for all of the personality disorders, including even the histrionic, schizoid, and paranoid. There is compelling multivariate behavior genetic support with respect to the precise structure of the Five-Factor Model (e.g., Yamagata et al., 2006), childhood antecedents (Caspi et al., 2005), universality (Allik, 2005), temporal stability across the lifespan (Roberts & DelVecchio, 2000), ties with brain structure (DeYoung et al., 2010), and even molecular genetic support for neuroticism (Widiger, 2009).

TREATMENT

Personality disorders are relatively unique because they are often "ego-syntonic;" that is, most people are largely comfortable with their selves, with their characteristic manner of behaving, feeling, and relating to others. As a result, people rarely seek treatment for their antisocial, narcissistic, histrionic, paranoid, and/or schizoid personality disorder. People typically lack insight into the maladaptivity of their personality.

One clear exception though is borderline personality disorder (and perhaps avoidant personality disorder, as well). Neuroticism is the domain of general personality structure that concerns inherent feelings of emotional pain and suffering, including feelings of distress, anxiety, depression, self-consciousness, helplessness, and vulnerability. Persons who have very high elevations on neuroticism (i.e., persons with borderline personality disorder) experience life as one of pain and suffering, and they will seek treatment to alleviate this severe emotional distress. People with avoidant personality may also seek treatment for their high levels of neuroticism (anxiousness and self-consciousness) and introversion (social isolation). In contrast, narcissistic individuals will rarely seek treatment to reduce their arrogance; paranoid persons rarely seek treatment to reduce their feelings of suspiciousness; and antisocial people rarely (or at least willfully) seek treatment to reduce their disposition for criminality, aggression, and irresponsibility.

Nevertheless, maladaptive personality traits will be evident in many individuals seeking treatment for other mental disorders, such as anxiety, mood, or substance use. Many of the people with a substance use disorder will have antisocial personality traits; many of the people with mood disorder will have borderline personality traits. The prevalence of personality disorders within clinical settings is estimated to be well above 50% (Torgersen, 2012). As many as 60% of inpatients within some clinical settings are diagnosed with borderline personality disorder (APA, 2000). Antisocial personality disorder may be diagnosed in as many as 50% of inmates within a correctional setting (Hare et al., 2012). It is estimated that 10% to 15% of the general population meets criteria for at least one of the ten *DSM-IV-TR* personality disorders (Torgersen, 2012), and quite a few more individuals are likely to have maladaptive personality traits not covered by one of the ten *DSM-5* diagnoses.

Many people with personality disorders do not seek treatment. Those with borderline personality disorder and avoidant personality disorder are exceptions. High levels of neuroticism and emotional pain may motivate them to seek help. ["people-1492052" by 1388843/Pixabay is in the public domain.]

FOCUS TOPIC

Treatment of Borderline Personality Disorder

Dialectical behavior therapy (Lynch & Cuper, 2012) and mentalization therapy (Bateman & Fonagy, 2012): Dialectical behavior therapy is a form of cognitive-behavioral therapy that draws on principles from Zen Buddhism, dialectical philosophy, and behavioral science. The treatment has four components: individual therapy, group skills training, telephone coaching, and a therapist consultation team, and will typically last a full year. For this reason, it is a relatively expensive form of treatment, but research has indicated that its benefits far outweighs its costs, both financially and socially. ■

The presence of a personality disorder will often have an impact on the treatment of other mental disorders, typically inhibiting or impairing responsivity. Antisocial persons will tend to be irresponsible and negligent; borderline persons can form intensely manipulative attachments to their therapists; paranoid patients will be unduly suspicious and accusatory; narcissistic patients can be dismissive and denigrating; and dependent patients can become overly attached to and feel helpless without their therapists.

It is a misconception, though, that personality disorders cannot themselves be treated. Personality disorders are among the most difficult of disorders to treat because they involve well-established behaviors that can be integral to a client's self-image (Millon, 2011). Nevertheless, much has been written on the treatment of personality disorders (e.g., Beck et al., 2006; Gunderson & Gabbard, 2000), and there is empirical support for clinically and socially meaningful changes in response to psychosocial and pharmacologic treatments (Perry & Bond, 2000). The development of an ideal or fully healthy personality structure is unlikely to occur through the course of treatment, but given the considerable social, public health, and personal costs associated with some of the personality disorders, such as antisocial and borderline, even just

moderate adjustments in personality functioning can represent quite significant and meaningful change.

Nevertheless, manualized and/or empirically validated treatment protocols have been developed for only one personality disorder, borderline (APA, 2001).

It is unclear why specific and explicit treatment manuals have not been developed for the other personality disorders. This may reflect a regrettable assumption that personality disorders are unresponsive to treatment. It may also reflect the complexity of their treatment. As noted earlier, each *DSM-5* disorder is a heterogeneous constellation of maladaptive personality traits. In fact, a person can meet diagnostic criteria for the antisocial, borderline, schizoid, schizotypal, narcissistic, and avoidant personality disorders and yet have only one diagnostic criterion in common. For example, only five of nine features are necessary for the diagnosis of borderline personality disorder; therefore, two persons can meet criteria for this disorder and yet have only one feature in common. In addition, patients meeting diagnostic criteria for one personality disorder will often meet diagnostic criteria for another. This degree of diagnostic overlap and heterogeneity of membership hinders tremendously any effort to identify a specific etiology, pathology, or treatment for a respective personality disorder as there is so much variation within any particular group of patients sharing the same diagnosis (Smith & Zapolski, 2009).

Of course, this diagnostic overlap and complexity did not prevent researchers and clinicians from developing dialectical behavior therapy and mentalization therapy. A further reason for the weak progress in treatment development is that, as noted earlier, persons rarely seek treatment for their personality disorder. It would be difficult to obtain a sufficiently large group of people with, for instance, narcissistic or obsessive–compulsive disorder to participate in a treatment outcome study, one receiving the manualized treatment protocol, the other receiving treatment as usual.

CONCLUSION

It is evident that all individuals have a personality, as indicated by their characteristic way of thinking, feeling, behaving, and relating to others. For some people, these traits result in a considerable degree of distress and/or impairment, constituting a personality disorder. A considerable body of research has accumulated to help understand the etiology, pathology, and treatment of some personality disorders (i.e., antisocial, schizotypal, borderline, dependent, and narcissistic), but not so much for others (e.g., histrionic, schizoid, and paranoid). However, researchers and clinicians are now shifting toward a more dimensional understanding of personality disorders, wherein each is understood as a maladaptive variant of general personality structure, thereby bringing to bear all that is known about general personality functioning to an understanding of these maladaptive variants.

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READING 38

Therapeutic Orientations

Hannah Boettcher, Stefan G. Hofmann, and Q. Jade Wu

SOURCE

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LEARNING OBJECTIVES

- Become familiar with the most widely practiced approaches to psychotherapy.
- For each therapeutic approach, consider history, goals, key techniques, and empirical support.
- Consider the impact of emerging treatment strategies in mental health.

KEY TERMS

acceptance and commitment therapy (ACT)
automatic thoughts
cognitive-behavioral therapy (CBT)
cognitive bias modification
cognitive restructuring
comorbidity
dialectical behavior therapy (DBT)
dialectical worldview
eclectic psychotherapy
exposure therapy
free association
integrative psychotherapy
mindfulness
mindfulness-based therapy (MBT)
person-centered therapy
psychoanalytic therapy
psychodynamic therapy
reappraisal
schemas
unconditional positive regard

In the past century, a number of psychotherapeutic orientations have gained popularity for treating mental illnesses. This module outlines some of the best-known therapeutic approaches and explains the history, techniques, advantages, and disadvantages associated with each. The most effective modern approach is cognitive-behavioral therapy (CBT). We also discuss psychoanalytic therapy, person-centered therapy, and mindfulness-based approaches. Drug therapy and emerging new treatment strategies will also be briefly explored.

INTRODUCTION

The history of mental illness can be traced as far back as 1500 BCE, when the ancient Egyptians noted cases of "distorted concentration" and "emotional distress in the heart or mind" (Nasser, 1987). Today, nearly half of all Americans will experience mental illness at some point in their lives, and mental health problems affect more than one-quarter of the population in any given year (Kessler et al., 2005). Fortunately, a range of psychotherapies exist to treat mental illnesses. This module provides an overview of some of the best-known schools of thought in psychotherapy. Currently, the most effective approach is called cognitive-behavioral therapy (CBT); however, other approaches, such as psychoanalytic therapy, person-centered therapy, and mindfulness-based therapies are also used—although the effectiveness of these treatments isn't as clear as it is for CBT. Throughout this module, note the advantages and disadvantages of each approach, paying special attention to their support by empirical research.

CBT is an approach to treating mental illness that involves work with a therapist as well as homework assignments between sessions. It has proven to be very effective for virtually all psychiatric illnesses. ["PNG counselling service for women" by AusAID/DFAT/Flickr is licensed under CC BY 2.0.]

PSYCHOANALYSIS AND PSYCHODYNAMIC THERAPY

The earliest organized therapy for mental disorders was psychoanalysis. Made famous in the early twentieth century by one of the best-known clinicians of all time, Sigmund Freud, this approach stresses that mental health problems are rooted in unconscious conflicts and desires. In order to resolve the mental illness, then, these unconscious struggles must be identified and addressed. Psychoanalysis often does this through exploring one's early childhood experiences that may have continuing repercussions on one's mental health in the present and later in life. Psychoanalysis is an intensive, long-term approach in which patients and therapists may meet multiple times per week, often for many years.

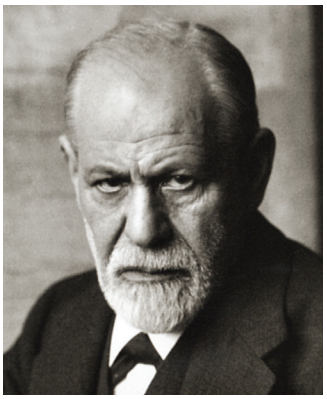
History of Psychoanalytic Therapy

Freud initially suggested that mental health problems arise from efforts to push inappropriate sexual urges out of conscious awareness (Freud, 1895/1955). Later, Freud suggested more generally that psychiatric problems are the result of tension between different parts of the mind: the id, the superego, and the ego. In Freud's *structural model,* the id represents pleasure-driven unconscious urges (e.g., our animalistic desires for sex and aggression), while the superego is the semi-conscious part of the mind where morals and societal judgment are internalized (e.g., the part of you that automatically knows how society expects you to behave). The ego—also partly conscious—mediates between the id and superego. Freud believed that bringing unconscious struggles like these (where the id demands one thing and the superego another) into conscious awareness would relieve the stress of the conflict (Freud, 1920/1955)—which became the goal of **psychoanalytic therapy**.

Although psychoanalysis is still practiced today, it has largely been replaced by the more broadly defined **psychodynamic therapy**. This latter approach has the same basic tenets as psychoanalysis but is briefer, makes more of an effort to put clients in their social and interpersonal context, and focuses more on relieving psychological distress than on changing the person.

Techniques in Psychoanalysis

Psychoanalysts and psychodynamic therapists employ several techniques to explore a patient's unconscious mind. One common technique is called **free association**. Here, the patient shares any and all thoughts that come to mind, without attempting to organize or censor them in any way. For example, if you took a pen and paper and just wrote down whatever came into your head, letting one thought lead to the next without allowing conscious criticism to shape what you were writing, you would be doing free association. The analyst then uses his or her expertise to discern patterns or underlying meaning in the patient's thoughts.



Sigmund Freud. Building on the work of Josef Breuer and others, Freud developed psychotherapeutic theories and techniques that became widely known as psychoanalysis or psychoanalytic therapy. ["Sigmund Freud 1926" by Ferdinand Schmutzer/Wikimedia Commons is in the public domain.]

Sometimes, free association exercises are applied specifically to childhood recollections. That is, psychoanalysts believe a person's childhood relationships with caregivers often determine the way that person relates to others, and predicts later psychiatric difficulties. Thus, exploring these childhood memories, through free association or otherwise, can provide therapists with insights into a patient's psychological makeup.

Because we don't always have the ability to consciously recall these deep memories, psychoanalysts also discuss their patients' dreams. In Freudian theory, dreams contain not only *manifest* (or literal) content, but also *latent* (or symbolic) content (Freud, 1900/1955). For example, someone may have a dream that his/her teeth are falling out—the manifest or actual content of the dream. However, dreaming that one's teeth are falling out could be a reflection of the person's unconscious concern about losing his or her physical attractiveness—the latent or metaphorical content of the dream. It is the therapist's job to help discover the latent content underlying one's manifest content through dream analysis.

In psychoanalytic and psychodynamic therapy, the therapist plays a receptive role—interpreting the patient's thoughts and behavior based on clinical experience and psychoanalytic theory. For example, if during therapy a patient begins to express unjustified anger toward the therapist, the therapist may recognize this as an act of *transference.* That is, the patient may be displacing feelings for people in his or her life (e.g., anger toward a parent) onto the therapist. At the same time, though, the therapist has to be aware of his or her own thoughts and emotions, for, in a related process called *countertransference*, the therapist may displace his/her own emotions onto the patient.

The key to psychoanalytic theory is to have patients uncover the buried, conflicting content of their mind, and therapists use various tactics—such as seating patients to face away from them—to promote a freer self-disclosure. And, as a therapist spends more time with a patient, the therapist can come to view his or her relationship with the patient as another reflection of the patient's mind.

Advantages and Disadvantages of Psychoanalytic Therapy

Psychoanalysis was once the only type of psychotherapy available, but presently the number of therapists practicing this approach is decreasing around the world. Psychoanalysis is not appropriate for some types of patients, including those with severe psychopathology or intellectual disability. Further, psychoanalysis is often expensive because treatment usually lasts many years. Still, some patients and therapists find the prolonged and detailed analysis very rewarding.

Perhaps the greatest disadvantage of psychoanalysis and related approaches is the lack of empirical support for their effectiveness. The limited research that has been conducted on these treatments suggests that they do not reliably lead to better mental health outcomes (e.g., Driessen et al., 2010). And, although there are some reviews that seem to indicate that long-term psychodynamic therapies might be beneficial (e.g., Leichsenring & Rabung, 2008). other researchers have questioned the validity of these reviews. Nevertheless, psychoanalytic theory was history's first attempt at formal treatment of mental illness, setting the stage for the more modern approaches used today.

HUMANISTIC AND PERSON-CENTERED THERAPY

One of the next developments in therapy for mental illness, which arrived in the mid-twentieth century, is called humanistic or **person-centered therapy** (PCT). Here, the belief is that mental health problems result from an inconsistency between patients' behavior and their true personal identity. Thus, the goal of PCT is to create conditions under which patients can discover their self-worth, feel comfortable exploring their own identity, and alter their behavior to better reflect this identity.

The quality of the relationship between therapist and patient is of great importance in person-centered therapy. [This work, "Person-Centered Therapy," is licensed under CC BY-NC-SA 4.0 by Judy Schmitt. It is a derivative of an untitled image by Noba Project, which is in the public domain.]

History of Person-Centered Therapy

PCT was developed by a psychologist named Carl Rogers, during a time of significant growth in the movements of humanistic theory and human potential. These perspectives were based on the idea that humans have an inherent drive to realize and express their own capabilities and creativity. Rogers, in particular, believed that all people have the potential to change and improve, and that the role of therapists is to foster self-understanding in an environment where adaptive change is most likely to occur (Rogers, 1951). Rogers suggested that the therapist and patient must engage in a genuine, egalitarian relationship in which the therapist is nonjudgmental and empathetic. In PCT, the patient should experience both a vulnerability to anxiety, which motivates the desire to change, and an appreciation for the therapist's support.

Techniques in Person-Centered Therapy

Humanistic and person-centered therapy, like psychoanalysis, involves a largely unstructured conversation between the therapist and the patient. Unlike psychoanalysis, though, a therapist using PCT takes a passive role, guiding the patient toward his or her own self-discovery. Rogers's original name for PCT was *non-directive therapy*, and this notion is reflected in the flexibility found in PCT. Therapists do not try to change patients' thoughts or behaviors directly. Rather, their role is to provide the therapeutic relationship as a platform for personal growth. In these kinds of sessions, the therapist tends only to ask questions and doesn't provide any judgment or interpretation of what the patient says. Instead, the therapist is present to provide a safe and encouraging environment for the person to explore these issues for himself or herself.

An important aspect of the PCT relationship is the therapist's **unconditional positive regard** for the patient's feelings and behaviors. That is, the therapist is never to condemn or criticize the patient for what he or she has done or thought; the therapist is only to express warmth and empathy. This creates an environment free of approval or disapproval, where patients come to appreciate their value and to behave in ways that are congruent with their own identity.

Advantages and Disadvantages of Person-Centered Therapy

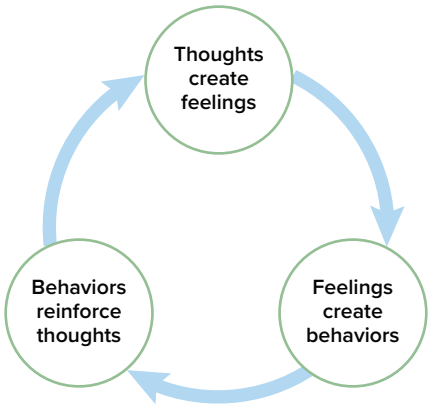
One key advantage of person-centered therapy is that it is highly acceptable to patients. In other words, people tend to find the supportive, flexible environment of this approach very rewarding. Furthermore, some of the themes of PCT translate well to other therapeutic approaches. For example, most therapists of any orientation find that clients respond well to being treated with nonjudgmental empathy. The main

disadvantage to PCT, however, is that findings about its effectiveness are mixed. One possibility for this could be that the treatment is primarily based on *unspecific treatment factors*. That is, rather than using therapeutic techniques that are specific to the patient and the mental problem (i.e., *specific treatment factors*), the therapy focuses on techniques that can be applied to anyone (e.g., establishing a good relationship with the patient) (Cuijpers et al., 2012; Friedli et al., 1997). Similar to how "one-size-fits-all" doesn't really fit every person, PCT uses the same practices for everyone, which may work for some people but not others. Further research is necessary to evaluate its utility as a therapeutic approach.

COGNITIVE-BEHAVIORAL THERAPY

Although both psychoanalysis and PCT are still used today, another therapy, **cognitive-behavioral therapy (CBT)**, has gained more widespread support and practice. CBT refers to a family of therapeutic approaches whose goal is to alleviate psychological symptoms by changing their underlying cognitions and behaviors. The premise of CBT is that thoughts, behaviors, and emotions interact and contribute to various mental disorders. For example, let's consider how a CBT therapist would view a patient who compulsively washes her hands for hours every day. First, the therapist would identify the patient's maladaptive thought: "If I don't wash my hands like this, I will get a disease and die." The therapist then identifies how this maladaptive *thought* leads to a maladaptive *emotion*: the feeling of anxiety when her hands aren't being washed. And finally, this maladaptive emotion leads to the maladaptive behavior: the patient washing her hands for hours every day.

CBT is a present-focused therapy (i.e., focused on the "now" rather than causes from the past, such as childhood relationships) that uses behavioral goals to improve one's mental illness. Often, these behavioral goals involve between-session homework assignments. For example, the therapist may give the hand-washing patient a worksheet to take home; on this worksheet, the woman is to write down every time she feels the urge to wash her hands, how she deals with the urge, and what behavior she replaces that urge with. When the patient has her next therapy session, she and the therapist review her "homework" together. CBT is a relatively brief intervention of 12 to 16 weekly sessions, closely tailored to the nature of the psychopathology and treatment of the specific mental disorder. And, as the empirical data shows, CBT has proven to be highly efficacious for virtually all psychiatric illnesses (Hofmann et al., 2012).



Pattern of thoughts, feelings, and behaviors addressed through cognitive-behavioral therapy. ["Cognitive-Behavioral Therapy" by Judy Schmitt is licensed under CC BY-NC-SA 4.0.]

History of Cognitive-behavioral Therapy

CBT developed from clinical work conducted in the mid-twentieth century by Dr. Aaron T. Beck, a psychiatrist, and Albert Ellis, a psychologist. Beck used the term **automatic thoughts** to refer to the thoughts depressed patients report experiencing spontaneously. He observed that these thoughts arise from three belief systems, or **schemas**: beliefs about the self, beliefs about the world, and beliefs about the future. In treatment, therapy initially focuses on identifying automatic thoughts (e.g., "If I don't wash my hands constantly, I'll get a disease"), testing their validity, and replacing maladaptive thoughts with more adaptive thoughts (e.g., "Washing my hands three times a day is sufficient to prevent a disease"). In later stages of treatment, the patient's maladaptive schemas are examined and modified. Ellis (1957) took a comparable approach, in what he called rational-emotive-behavioral therapy (REBT), which also encourages patients to evaluate their own thoughts about situations.

Techniques in CBT

Beck and Ellis strove to help patients identify maladaptive appraisals, or the untrue judgments and evaluations of certain thoughts. For example, if it's your first time meeting new people, you may have the automatic thought, "These people won't like me because I have nothing interesting to share." That thought itself is not what's troublesome; the appraisal (or evaluation) that it might have merit is what's troublesome. The goal of CBT is to help people make adaptive, instead of maladaptive, appraisals (e.g., "I do know interesting things!"). This technique of **reappraisal**, or **cognitive restructuring**, is a fundamental aspect of CBT. With cognitive restructuring, it is the therapist's job to help point out when a person has an inaccurate or maladaptive thought, so that the patient can either eliminate it or modify it to be more adaptive.

In addition to *thoughts*, though, another important treatment target of CBT is maladaptive *behavior*. Every time a person engages in maladaptive behavior (e.g., never speaking to someone in new situations), he or she reinforces the

validity of the maladaptive thought, thus maintaining or perpetuating the psychological illness. In treatment, the therapist and patient work together to develop healthy behavioral habits (often tracked with worksheet-like homework), so that the patient can break this cycle of maladaptive thoughts and behaviors.

For many mental health problems, especially anxiety disorders, CBT incorporates what is known as **exposure therapy**. During exposure therapy, a patient confronts a problematic situation and fully engages in the experience instead of avoiding it. For example, imagine a man who is terrified of spiders. Whenever he encounters one, he immediately screams and panics. In exposure therapy, the man would be forced to confront and interact with spiders, rather than simply avoiding them as he usually does. The goal is to reduce the fear associated with the situation through *extinction learning,* a neurobiological and cognitive process by which the patient "unlearns" the irrational fear. For example, exposure therapy for someone terrified of spiders might begin with him looking at a cartoon of a spider, followed by him looking at pictures of real spiders, and later, him handling a plastic spider. After weeks of this incremental exposure, the patient may even be able to hold a live spider. After repeated exposure (starting small and building one's way up), the patient experiences less physiological fear and maladaptive thoughts about spiders, breaking his tendency for anxiety and subsequent avoidance.

Advantages and Disadvantages of CBT

CBT interventions tend to be relatively brief, making them cost-effective for the average consumer. In addition, CBT is an intuitive treatment that makes logical sense to patients. It can also be adapted to suit the needs of many different populations. One disadvantage, however, is that CBT does involve significant effort on the patient's part, because the patient is an active participant in treatment. Therapists often assign "homework" (e.g., worksheets for recording one's thoughts and behaviors) between sessions to maintain the cognitive and behavioral habits the patient is working on. The greatest strength of CBT is the abundance of empirical support for its effectiveness. Studies have consistently found CBT to be as effective as or more effective than other forms of treatment, including medication and other therapies (Butler et al., 2006; Hofmann et al., 2012). For this reason, CBT is considered a first-line treatment for many mental disorders.

ACCEPTANCE AND MINDFULNESS-BASED APPROACHES

Unlike the preceding therapies, which were developed in the twentieth century, this next one was born out of age-old Buddhist and yoga practices. **Mindfulness**, or a process that tries to cultivate a nonjudgmental, yet attentive, mental state, is a therapy that focuses on one's awareness of bodily sensations, thoughts, and the outside environment. Whereas other therapies work to modify or eliminate these sensations and thoughts, mindfulness focuses on nonjudgmentally accepting them (Kabat-Zinn, 2003; Baer, 2003). For example, whereas CBT may actively confront and work to change a maladaptive thought, mindfulness therapy works to acknowledge and accept the thought, understanding that the thought is spontaneous and not what the person truly believes. There are two important components of mindfulness: (1) self-regulation of attention, and (2) orientation toward the present moment (Bishop et al., 2004). Mindfulness is thought to improve mental health because it draws attention away from past and future stressors, encourages acceptance of troubling thoughts and feelings, and promotes physical relaxation.

Techniques in Mindfulness-Based Therapy

Psychologists have adapted the practice of mindfulness as a form of psychotherapy, generally called **mindfulness-based therapy (MBT)**. Several types of MBT have become popular in recent years, including *mindfulness-based stress reduction* (MBSR) (e.g., Kabat-Zinn, 1982) and *mindfulness-based cognitive therapy* (MBCT) (e.g., Segal et al., 2002).

FOCUS TOPIC

Pioneers of CBT

The central notion of CBT is the idea that a person's behavioral and emotional responses are causally influenced by one's thinking. The stoic Greek philosopher Epictetus is quoted as saying, "men are not moved by things, but by the view they take of them." Meaning, it is not the event per se, but rather one's assumptions (including interpretations and perceptions) of the event that are responsible for one's emotional response to it. Beck calls these assumptions about events and situations automatic thoughts (Beck, 1979), whereas Ellis (1962) refers to these assumptions as self-statements. The cognitive model assumes that these cognitive processes cause the emotional and behavioral responses to events or stimuli. This causal chain is illustrated in Ellis's ABC model, in which A stands for the antecedent event, B stands for belief, and C stands for consequence. During CBT, the person is encouraged to carefully observe the sequence of events and the response to them, and then explore the validity of the underlying beliefs through behavioral experiments and reasoning, much like a detective or scientist. ■

One of the most important advantages of mindfulness-based therapy is its level of accessibility to patients. ["Meditating in Union Station" by Wayne MacPhail/Flickr is licensed under CC BY-NC-SA 2.0.]

MBSR uses meditation, yoga, and attention to physical experiences to reduce stress. The hope is that reducing a person's overall stress will allow that person to more objectively evaluate his or her thoughts. In MBCT, rather than reducing one's general stress to address a specific problem, attention is focused on one's thoughts and their associated emotions. For example, MBCT helps prevent relapses in depression by encouraging patients to evaluate their own thoughts objectively and without value judgment (Baer, 2003). Although cognitive-behavioral therapy (CBT) may seem similar to this, it focuses on "pushing out" the maladaptive thought, whereas mindfulness-based cognitive therapy focuses on "not getting caught up" in it. The treatments used in MBCT have been used to address a wide range of illnesses, including depression, anxiety, chronic pain, coronary artery disease, and fibromyalgia (Hofmann et al., 2010).

Mindfulness and acceptance—in addition to being therapies in their own right—have also been used as "tools" in other cognitive-behavioral therapies, particularly in **dialectical behavior therapy (DBT)** (e.g., Linehan et al., 1991). DBT, often used in the treatment of borderline personality disorder, focuses on skills training. That is, it often employs mindfulness and cognitive-behavioral therapy practices, but it also works to teach patients "skills" they can use to correct maladaptive tendencies. For example, one skill DBT teaches patients is called *distress tolerance*—or, ways to cope with maladaptive thoughts and emotions in the moment. For example, people who feel an urge to cut themselves may be taught to snap their arm with a rubber band instead. The primary difference between DBT and CBT is that DBT employs techniques that address the symptoms of the problem (e.g., cutting oneself) rather than the problem itself (e.g., understanding the psychological motivation to cut oneself). CBT does not teach such skills training because of the concern that the skills—even though they may help in the short-term—may be harmful in the long-term, by maintaining maladaptive thoughts and behaviors.

DBT is founded on the perspective of a **dialectical worldview**. That is, rather than thinking of the world as "black and white," or "only good or only bad," it focuses on accepting that some things can have characteristics of both "good" and "bad." So, in a case involving maladaptive thoughts, instead of teaching that a thought is entirely bad, DBT tries to help patients be less judgmental of their thoughts (as with mindfulness-based therapy) and encourages change through therapeutic progress, using cognitive-behavioral techniques as well as mindfulness exercises.

Another form of treatment that also uses mindfulness techniques is **acceptance and commitment therapy (ACT)**. In this treatment, patients are taught to observe their thoughts from a detached perspective (Hayes et al., 1999). ACT encourages patients *not* to attempt to change or avoid thoughts and emotions they observe in themselves, but to recognize which are beneficial and which are harmful. However, the differences among ACT, CBT, and other mindfulness-based treatments are a topic of controversy in the current literature.

Advantages and Disadvantages of Mindfulness-Based Therapy

Two key advantages of mindfulness-based therapies are their acceptability and accessibility to patients. Because yoga and meditation are already widely known in popular culture, consumers of mental healthcare are often interested in trying related psychological therapies. Currently, psychologists have not come to a consensus on the efficacy of MBT, though growing evidence supports its effectiveness for treating mood and anxiety disorders. For example, one review of MBT studies for anxiety and depression found that mindfulness-based interventions generally led to moderate symptom improvement (Hofmann et al., 2010).

EMERGING TREATMENT STRATEGIES

With growth in research and technology, psychologists have been able to develop new treatment strategies in recent years. Often, these approaches focus on enhancing existing treatments, such as cognitive-behavioral therapies, through the use of technological advances. For example, *internet-* and *mobile-delivered therapies* make psychological treatments more available, through smartphones and online access. Clinician-supervised online CBT modules allow patients to access treatment from home on their own schedule—an opportunity particularly important for patients with less geographic

Recent improvements in video chat technology along with the proliferation of mobile devices like smartphones and tablets has made online delivery of therapy more commonplace. [Untitled image by Noba is licensed under CC BY 2.0.]

or socioeconomic access to traditional treatments. Furthermore, smartphones help extend therapy to patients' daily lives, allowing for symptom tracking, homework reminders, and more frequent therapist contact.

Another benefit of technology is **cognitive bias modification**. Here, patients are given exercises, often through the use of video games, aimed at changing their problematic thought processes. For example, researchers might use a mobile app to train alcohol abusers to avoid stimuli related to alcohol. One version of this game flashes four pictures on the screen—three alcohol cues (e.g., a can of beer, the front of a bar) and one health-related image (e.g., someone drinking water). The goal is for the patient to tap the healthy picture as fast as he or she can. Games like these aim to target patients' automatic, subconscious thoughts that may be difficult to direct through conscious effort. That is, by repeatedly tapping the healthy image, the patient learns to "ignore" the alcohol cues, so when those cues are encountered in the environment, they will be less likely to trigger the urge to drink. Approaches like these are promising because of their accessibility; however, they require further research to establish their effectiveness.

Yet another emerging treatment employs *CBT-enhancing pharmaceutical agents*. These are drugs used to improve the effects of therapeutic interventions. Based on research from animal experiments, researchers have found that certain drugs influence the biological processes known to be involved in learning. Thus, if people take these drugs while going through psychotherapy, they are better able to "learn" the techniques for improvement. For example, the antibiotic D-cycloserine improves treatment for anxiety disorders by facilitating the learning processes that occur during exposure therapy. Ongoing research in this exciting area may prove to be quite fruitful.

PHARMACOLOGICAL TREATMENTS

Up until this point, all the therapies we have discussed have been talk-based or meditative practices. However, psychiatric medications are also frequently used to treat mental disorders, including schizophrenia, bipolar disorder, depression, and anxiety disorders. Psychiatric drugs are commonly used, in part, because they can be prescribed by general medical practitioners, whereas only trained psychologists are qualified to deliver effective psychotherapy. While drugs and CBT therapies tend to be almost equally effective, choosing the best intervention depends on the disorder and individual being treated, as well as other factors—such as treatment availability and **comorbidity** (i.e., having multiple mental or physical disorders at once). Although many new drugs have been introduced in recent decades, there is still much we do not understand about their mechanisms in the brain. Further research is needed to refine our understanding of both pharmacological and behavioral treatments before we can make firm claims about their effectiveness.

INTEGRATIVE AND ECLECTIC PSYCHOTHERAPY

In discussing therapeutic orientations, it is important to note that some clinicians incorporate techniques from multiple approaches, a practice known as **integrative psychotherapy** or **eclectic psychotherapy**. For example, a therapist may employ distress tolerance skills from DBT (to resolve short-term problems), cognitive reappraisal from CBT (to address long-standing issues), and mindfulness-based meditation from MBCT (to reduce overall stress). And, in fact, between 13% and 42% of therapists have identified their own approaches as integrative or eclectic (Norcross & Goldfried, 2005).

CONCLUSION

Throughout human history we have had to deal with mental illness in one form or another. Over time, several schools of thought have emerged for treating these problems. Although various therapies have been shown to work for specific individuals, cognitive-behavioral therapy is currently the treatment most widely supported by empirical research. Still, practices like psychodynamic therapies, person-centered therapy, mindfulness-based treatments, and acceptance and commitment therapy have also shown success. And, with recent advances in research and technology, clinicians are able to enhance these and other therapies to treat more patients more effectively than ever before. However, what is important in the end is that people actually seek out mental health specialists to help them with their problems. One of the biggest deterrents to doing so is that people don't understand what psychotherapy really entails. Through understanding how current practices work, not only can we better educate people about how to get the help they need, but we can continue to advance our treatments to be more effective in the future.

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READING 39

Psychopharmacology

Susan Barron

SOURCE

Barron, S. (2020). Psychopharmacology. In R. Biswas-Diener & E. Diener (Eds.), *Noba textbook series: Psychology.* DEF Publishers. http://noba.to/umx6f2t8

LEARNING OBJECTIVES

- Identify how most psychoactive drugs work in the brain.
- Learn how the route of administration affects how rewarding a drug might be.
- Understand why grapefruit is dangerous to consume with many psychotropic medications.
- Describe why individualized drug doses based on genetic screening might be helpful for treating conditions like depression.
- Articulate the controversy regarding pharmacotherapy for children, adolescents, and the elderly.

KEY TERMS

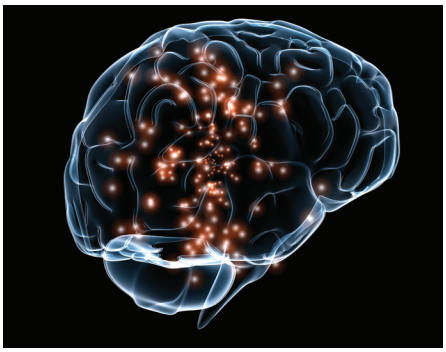
agonists
antagonists
enzyme induction
enzymes
metabolism
neurotransmitter
pharmacokinetics
polypharmacy
psychoactive drugs
psychotropic drug
synapse

Psychopharmacology is the study of how drugs affect behavior. If a drug changes your perception, or the way you feel or think, the drug exerts effects on your brain and nervous system. We call drugs that change the way you think or feel psychoactive or psychotropic drugs, and almost everyone has used a psychoactive drug at some point (yes, caffeine counts). Understanding some of the basics about psychopharmacology can help us better understand a wide range of things that interest psychologists and others. For example, the pharmacological treatment of certain neurodegenerative diseases such as Parkinson's disease tells us something about the disease itself. The pharmacological treatments used to treat psychiatric conditions such as schizophrenia or depression have undergone amazing development since the 1950s, and the drugs used to treat these disorders tell us something about what is happening in the brain of individuals with these conditions. Finally, understanding something about the actions of drugs of abuse and their routes of administration can help us understand why some psychoactive drugs are so addictive. In this module, we will provide an overview of some of these topics and discuss some current controversial areas in the field of psychopharmacology.

INTRODUCTION

Psychopharmacology, the study of how drugs affect the brain and behavior, is a relatively new science, although people have probably been taking drugs to change how they feel from early in human history (consider the practice of eating fermented fruit, mixing up ancient beer recipes, and chewing on the leaves of the cocaine plant for stimulant properties as just some examples). The word *psychopharmacology* itself tells us that this is a field that bridges our understanding of behavior (and brain) and pharmacology, and the range of topics included within this field is extremely broad.

Virtually any drug that changes the way you feel does this by altering how neurons communicate with each other. Neurons (more than 100 billion in your nervous system) communicate with each other by releasing a chemical (a **neurotransmitter**) across a tiny space between two neurons (the **synapse**). When the neurotransmitter crosses the



Drugs that alter our feelings and behavior do so by affecting the communication between neurons in the brain. ["SUBNET Final 1" by DARPA is in the public domain.]

TABLE 39.1. Neurotransmitters and Their Related Behaviors or Diseases

Neurotransmitter	Abbreviation	Behaviors or Diseases Related to These Neurotransmitters
Acetylcholine	Ach	Learning and memory; Alzheimer's disease; muscle movement in the peripheral nervous system
Dopamine	DA	Reward circuits; motor circuits involved in Parkinson's disease; schizophrenia
Norepinephrine	NE	Arousal; depression
Serotonin	5HT	Depression; aggression; schizophrenia
Glutamate	GLU	Learning; major excitatory neurotransmitter in the brain
GABA	GABA	Anxiety disorders; epilepsy; major inhibitory neurotransmitter in the brain
Endogenous opioids	Endorphins, enkephalins	Pain; analgesia; reward

synapse, it binds to a postsynaptic receptor (protein) on the receiving neuron and the message may then be transmitted onward. Obviously, neurotransmission is far more complicated than this, but the first step is understanding that virtually all **psychoactive drugs** interfere with or alter how neurons communicate with each other.

There are many neurotransmitters. Some of the most important in terms of psychopharmacological treatment and drugs of abuse are outlined in TABLE 39.1. The neurons that release these neurotransmitters, for the most part, are localized within specific circuits of the brain that mediate these behaviors. Psychoactive drugs can either increase activity at the synapse (these are called **agonists**) or reduce activity at the synapse (**antagonists**). Different drugs do this by different mechanisms, and some examples of agonists and antagonists are presented in TABLE 39.2. For each example, the drug's trade name, which is the name of the drug provided by the drug company, and generic name (in parentheses) are provided.

TABLE 39.2 provides examples of drugs and their primary mechanisms of action, but it is very important to realize that drugs also have effects on other neurotransmitters. This contributes to the kinds of side effects that are observed when someone takes a particular drug. The reality is that no drugs currently available work only exactly where we would like in the brain or only on a specific neurotransmitter. In many cases, individuals are sometimes prescribed one **psychotropic drug** but then may also have to take additional drugs to reduce the side effects caused by the initial drug. Sometimes individuals stop taking medication because the side effects can be so profound.

PHARMACOKINETICS: WHAT IS IT AND WHY IS IT IMPORTANT?

While this section may sound more like pharmacology, it is important to realize how important pharmacokinetics can be when considering psychoactive drugs. **Pharmacokinetics** refers to how the body handles a drug that we take. As mentioned earlier, psychoactive drugs exert their effects on behavior by altering neuronal communication in the brain, and the majority of drugs reach the brain by traveling in the blood. The acronym ADME is often used and stands for *absorption* (how the drug gets into the blood), *distribution* (how the drug gets to the organ of interest—in this module,

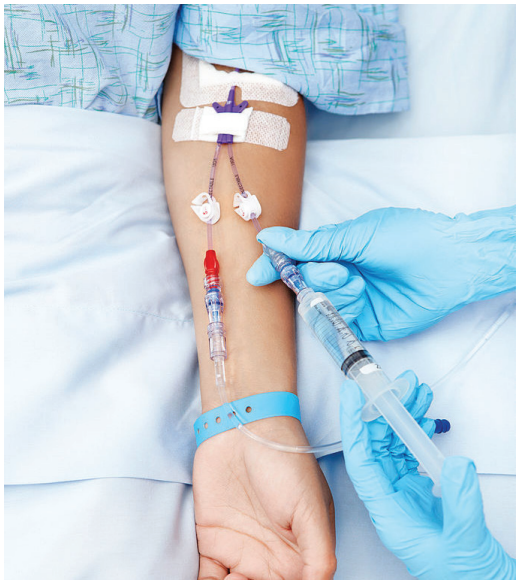
TABLE 39.2. Drugs and Their Primary Mechanisms of Action and Uses

Drug	Mechanism of Action	Use	Agonist/Antagonist
L-dopa	Increases synthesis of DA	Parkinson's disease	Agonist for DA
Adderall (mixed salts amphetamine)	Increases release of DA, NE	ADHD	Agonist for DA, NE
Ritalin (methylphenidate)	Blocks removal of DA, NE, and lesser (5HT) from synapse	ADHD	Agonist for DA, NE mostly
Aricept (donepezil)	Blocks removal of Ach from synapse	Alzheimer's disease	Agonist for Ach
Prozac (fluoxetine)	Blocks removal of 5HT from synapse	Depression, obsessive compulsive disorder	Agonist for 5HT
Seroquel (quetiapine)	Blocks DA and 5HT receptors	Schizophrenia, bipolar disorder	Antagonist for DA, 5HT
Revia (naltrexone)	Blocks opioid post-synaptic receptors	Alcoholism, opioid addiction	Antagonist (for opioids)

that is the brain), *metabolism* (how the drug is broken down so it no longer exerts its psychoactive effects), and *excretion* (how the drug leaves the body). We will talk about a couple of these to show their importance for considering psychoactive drugs.

Drug Administration

There are many ways to take drugs, and these routes of drug administration can have a significant impact on how quickly that drug reaches the brain. The most common route of administration is oral administration, which is relatively slow and—perhaps surprisingly—often the most variable and complex route of administration. Drugs enter the stomach and then get absorbed by the blood supply and capillaries that line the small intestine. The rate of absorption can be affected by a variety of factors including the quantity and the type of food in the stomach (e.g., fats vs. proteins). This is why the medicine label for some drugs (like antibiotics) may specifically state foods that you should or should *not* consume within an hour of taking the drug because they can affect the rate of absorption. Two of the most rapid routes of administration include inhalation (i.e., smoking or gaseous anesthesia) and intravenous (IV) in which the drug is injected directly into the vein and hence the blood supply. Both of these routes of administration can get the drug to the brain in less than 10 seconds. IV administration also has the distinction of being the most dangerous because if there is an adverse drug reaction, there is very little time to administer any antidote, as in the case of an IV heroin overdose.



A drug delivered by IV reaches the brain more quickly than if the drug is taken orally. While rapid delivery has advantages, there are also risks involved with IV administration. ["ICU IV 1" by Calleamanecer/Wikimedia Commons is licensed under CC BY-SA 3.0.]

Why might how quickly a drug gets to the brain be important? If a drug activates the reward circuits in the brain *and* it reaches the brain very quickly, the drug has a high risk for abuse and addiction. Psychostimulants like amphetamine or cocaine are examples of drugs that have high risk for abuse because they are agonists at DA neurons involved in reward *and* because these drugs exist in forms that can be either smoked or injected intravenously. Some argue that cigarette smoking is one of the hardest addictions to quit, and although part of the reason for this may be that smoking gets the nicotine into the brain very quickly (and indirectly acts on DA neurons), it is a more complicated story. For drugs that reach the brain very quickly, not only is the drug very addictive, but so are the cues associated with the drug (see Rohsenow et al., 1990). For a crack user, this could be the pipe that they use to smoke the drug. For a cigarette smoker, however, it could be something as normal as finishing dinner or waking up in the morning (if that is when the smoker usually has a cigarette). For both the crack user and the cigarette smoker, the cues associated with the drug may actually cause craving that is alleviated by (you guessed it)—lighting a cigarette or using crack (i.e., relapse). This is one of the reasons individuals who enroll in drug treatment programs, especially out-of-town programs, are at significant risk of relapse if they later find themselves in proximity to old haunts, friends, etc. But this is much *more* difficult for a cigarette smoker. How can someone avoid eating? Or avoid waking up in the morning, etc. These examples help you begin to understand how important the route of administration can be for psychoactive drugs.

Drug Metabolism

Metabolism involves the breakdown of psychoactive drugs, and this occurs primarily in the liver. The liver produces **enzymes** (proteins that speed up a chemical reaction), and these enzymes help catalyze a chemical reaction that breaks down psychoactive drugs. Enzymes exist in "families," and many psychoactive drugs are broken down by the same family of enzymes, the cytochrome P450 superfamily. There is not a unique enzyme for each drug; rather, certain enzymes can break down a wide variety of drugs. Tolerance to the effects of many drugs can occur with repeated exposure; that is, the drug produces less of an effect over time, so more of the drug is needed to get the same effect. This is particularly true for sedative drugs like alcohol or opiate-based painkillers. *Metabolic tolerance* is one kind of tolerance and it takes place in the liver. Some drugs (like alcohol) cause **enzyme induction**—an increase in the enzymes produced by the liver. For example, chronic drinking results in alcohol being broken down more quickly, so the alcoholic needs to drink more to get the same effect—of course, until so much alcohol is consumed that it damages the liver (alcohol can cause fatty liver or cirrhosis).

Grapefruit can interfere with enzymes in the liver that help the body to process certain drugs. ["Citrus paradisi (Grapefruit, pink)" by Aleph/Wikimedia Commons is licensed under CC BY-SA 2.5.]

RECENT ISSUES RELATED TO PSYCHOTROPIC DRUGS AND METABOLISM

Grapefruit Juice and Metabolism

Certain types of food in the stomach can alter the rate of drug absorption, and other foods can also alter the rate of drug metabolism. The most well known is grapefruit juice. Grapefruit juice suppresses cytochrome P450 enzymes in the liver, and these liver enzymes normally break down a large variety of drugs (including some of the psychotropic drugs). If the enzymes are suppressed, drug levels can build up to potentially toxic levels. In this case, the effects can persist for extended periods of time after the consumption of grapefruit juice. As of 2013, there are at least 85 drugs shown to adversely interact with grapefruit juice (Bailey et al., 2013).

Some psychotropic drugs that are likely to interact with grapefruit juice include carbamazepine (Tegretol), prescribed for bipolar disorder; diazepam (Valium), used to treat anxiety, alcohol withdrawal, and muscle spasms; and fluvoxamine (Luvox), used to treat obsessive compulsive disorder and depression.

Individualized Therapy, Metabolic Differences, and Potential Prescribing Approaches for the Future

Mental illnesses contribute to more disability in western countries than all other illnesses including cancer and heart disease. Depression alone is predicted to be the second largest contributor to disease burden by 2020 (World Health Organization, 2004). The numbers of people affected by mental health issues are pretty astonishing, with estimates that 25% of adults experience a mental health issue in any given year, and this affects not only the individual but their friends and family. One in 17 adults experiences a serious mental illness (Kessler et al., 2005). Newer antidepressants are probably the most frequently prescribed drugs for treating mental health issues, although there is no "magic bullet" for treating depression or other conditions. Pharmacotherapy with psychological therapy may be the most beneficial treatment approach for many psychiatric conditions, but there are still many unanswered questions. For example, why does one antidepressant help one individual yet have no effect for another? Antidepressants can take 4 to 6 weeks to start improving depressive symptoms, and we don't really understand why. Many people do not respond to the first antidepressant prescribed and may have to try different drugs before finding something that works for them. Other people just do not improve with antidepressants (Ioannidis, 2008). The better we understand why individuals differ, the easier and more rapidly we will be able to help people in distress.

One area that has received interest recently has to do with an individualized treatment approach. We now know that there are genetic differences in some of the cytochrome P450 enzymes and their ability to break down drugs. The general population falls into the following 4 categories: (1) *ultra-extensive metabolizers* break down certain drugs (like some of the current antidepressants) very, very quickly, (2) *extensive metabolizers* are also able to break down drugs fairly quickly, (3) *intermediate metabolizers* break down drugs more slowly than either of the two above groups, and finally (4) *poor metabolizers* break down drugs much more slowly than all of the other groups. Now consider someone receiving a prescription for an antidepressant—what would the consequences be if they were either an ultra-extensive metabolizer or a poor metabolizer? The ultra-extensive metabolizer would be given antidepressants and told it will probably take 4 to 6 weeks to begin working (this is true), but they metabolize the medication so quickly that it will never be effective for them. In contrast, the poor metabolizer given the same daily dose of the same antidepressant may build up such high levels in their blood (because they are not breaking the drug down), that they will have a wide range of side effects and feel really badly—also not a positive outcome. What if—instead—prior to prescribing an antidepressant, the doctor could take a blood sample and determine which type of metabolizer a patient actually was? They could then make a much more informed decision about the best dose to prescribe. There are new genetic tests now available to better individualize treatment in just this way. A blood sample can determine (at least for some drugs) which category an individual fits into, but we need data to determine if this actually is effective for treating depression or other mental illnesses (Zhou, 2009). Currently, this genetic test is expensive and not many health insurance plans cover this screen, but this may be an important component in the future of psychopharmacology.

There are concerns about both the safety and efficacy of drugs like Prozac for children and teens. ["Happy feet" by The Monkey/Flickr is licensed under CC BY-NC-ND 2.0.]

OTHER CONTROVERSIAL ISSUES

Juveniles and Psychopharmacology

A recent Centers for Disease Control (CDC) report has suggested that as many as 1 in 5 children between the ages of 5 and 17 may have some type of mental disorder (e.g., ADHD, autism, anxiety, depression) (CDC, 2013). The incidence of bipolar disorder in children and adolescents has also increased 40 times in the past decade (Moreno et al., 2007), and it is now estimated that 1 in 88 children have been diagnosed with an autism spectrum disorder (CDC, 2011). Why has there been such an increase in these numbers? There is no single answer to this important question. Some believe that greater public awareness has contributed to increased teacher and parent referrals. Others argue that the increase stems from changes in criterion currently used for diagnosing. Still others suggest environmental factors, either prenatally or postnatally, have contributed to this upsurge.

We do not have an answer, but the question does bring up an additional controversy related to how we should treat this population of children and adolescents. Many psychotropic drugs used for treating psychiatric disorders have been tested in adults, but few have been tested for safety or efficacy with children or adolescents. The most well-established psychotropics prescribed for children and adolescents are the psychostimulant drugs used for treating attention deficit hyperactivity disorder (ADHD), and there are clinical data on how effective these drugs are. However, we know far less about the safety and efficacy in young populations of the drugs typically prescribed for treating anxiety, depression, or other psychiatric disorders. The young brain continues to mature until probably well after age 20, so some scientists are concerned that drugs that alter neuronal activity in the developing brain could have significant consequences. There is an obvious need for clinical trials in children and adolescents to test the safety and effectiveness of many of these drugs, which also brings up a variety of ethical questions about who decides which children and adolescents will participate in these clinical trials, who can give consent, who receives reimbursements, etc.

The Elderly and Psychopharmacology

Another population that has not typically been included in clinical trials to determine the safety or effectiveness of psychotropic drugs is the elderly. Currently, there is very little high-quality evidence to guide prescribing for older people—clinical trials often exclude people with multiple comorbidities (other diseases, conditions, etc.), which are typical for elderly populations (see Hilmer & Gnjidic, 2008; Pollock et al., 2008). This is a serious issue because the elderly consume a disproportionate number of the prescription medications prescribed. The term **polypharmacy** refers to the use of multiple drugs, which is very common in elderly populations in the United States. As our population ages, some estimate that the proportion of people 65 or older will reach 20% of the U.S. population by 2030, with this group consuming 40% of the prescribed medications. As shown in **TABLE 39.3**, it is quite clear why the typical clinical trial that looks at the safety and effectiveness of psychotropic drugs can be problematic if we try to interpret these results for an elderly population.

Metabolism of drugs is often slowed considerably for elderly populations, so less drug can produce the same effect (or all too often, too much drug can result in a variety of side effects). One of the greatest risk factors for elderly populations is falling (and breaking bones), which can happen if the elderly person gets dizzy from too much of a drug. There is also evidence that psychotropic medications can reduce

TABLE 39.3. Characteristics of Clinical Trial Subjects vs. Actual Patients

Clinical Trial Subjects	Aged Patients Who Receive Drug Therapies
One drug	Drug of interest and medications
Single dose	Chronic administration
No disease	Multiple diseases
No alcohol, tobacco, OTC* drugs, nutraceuticals	OTC* drugs, nutraceuticals, alcohol, tobacco, and other
20–40 years (vs. 60–75 years)	65–100+ years
Caucasians	Caucasians and minorities
Selection bias	All comers/socioeconomic basis

*OTC = over the counter

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bone density (thus worsening the consequences if someone falls) (Brown & Mezuk, 2012). Although we are gaining an awareness about some of the issues facing pharmacotherapy in older populations, this is a very complex area with many medical and ethical questions.

This module provided an introduction of some of the important areas in the field of psychopharmacology. It should be apparent that this module just touched on a number of topics included in this field. It should also be apparent that understanding more about psychopharmacology is important to anyone interested in understanding behavior and that our understanding of issues in this field has important implications for society.

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