PeopleImages/Getty Images

The Story of Psychology

Harvard astronomer Owen Gingerich has described the human brain as "by far the most complex physical object known to us in the entire cosmos" (2006, p. 29). On the scale of outer space, we are less than a single grain of sand on all the oceans' beaches, and our lifetime is but a relative nanosecond. Yet there is nothing more awe inspiring than our own inner space. Our consciousness—our mind somehow arising from matter—remains a profound mystery. Our thinking, emotions, and actions (and their interplay with others' thinking, emotions, and actions) fascinate us. Outer space staggers us with its enormity. But inner space enthralls us. Enter psychological science.

From news and popular media portrayals, you might think that psychologists analyze personality, offer counseling, dispense child-raising advice, examine crime scenes, and testify in court. Do they? *Yes,* and much more. Consider some of psychology's questions that you may wonder about:

- Have you ever found yourself reacting to something as one of your biological parents would—perhaps in a way you vowed you *never* would—and then wondered how much of your personality you inherited? *To what extent do genes predispose our individual differences in personality? How do home and community environments shape us?*
- Have you ever worried about how to act among people of a different culture, race, gender identity, or sexual orientation? *In what ways are we alike as members of the human family? How do we differ?*

- Have you ever awakened from a nightmare and wondered why you had such a crazy dream? *Why do we dream?*
- Have you ever played peekaboo with a 6-month-old and wondered why the baby finds your disappearing/reappearing act so delightful? *What do babies actually perceive and think?*
- Have you ever wondered what fosters school and work success? *Does inborn intelligence explain why some people get richer, think more creatively, or relate more sensitively? Or does gritty effort, and a belief that we* can *grow smarter, matter more?*
- Have you ever become depressed or anxious and wondered whether you'll ever feel "normal"? *What triggers our bad moods—and our good ones? What's the line between a normal mood swing and a psychological disorder?*

Psychology is a science that seeks to answer such questions about us all—how and why we think, feel, and act as we do.

What Is Psychology?

Once upon a time, on a planet in our neighborhood of the universe, there came to be people. Soon thereafter, these creatures became intensely interested in themselves and in one another: "Who are we? What produces our thoughts? Our feelings? Our actions? And how are we to understand and manage those around us?"

Psychology Is a Science

To assist your active learning of psychology, numbered Learning Objectives, framed as questions, appear at the beginning of major sections. You can test your understanding by trying to answer the question before, and then again after, you read the section.

Throughout the text, important concepts are **boldfaced**. As you study, you can find these terms with their definitions in a nearby margin and in the Glossary at the end of the book. (In the e-book, definitions are always a click away.)

LOQ LEARNING OBJECTIVE QUESTION P-1 How is psychology a science, and why is it the "rat is always right"?

Underlying all science is, first, a passion to explore and understand without misleading or being misled. Some questions *(Is there life after death?)* are beyond science. Answering them in any way requires a leap of faith. With many other ideas *(Can some people demonstrate ESP?)*, the proof is in the pudding. Let the facts speak for themselves.

Magician James Randi has used this **empirical approach** when testing those claiming to see glowing auras around people's bodies:

Randi: Do you see an aura around my head?

Aura seer: Yes, indeed.

Randi: Can you still see the aura if I put this magazine in front of my face?

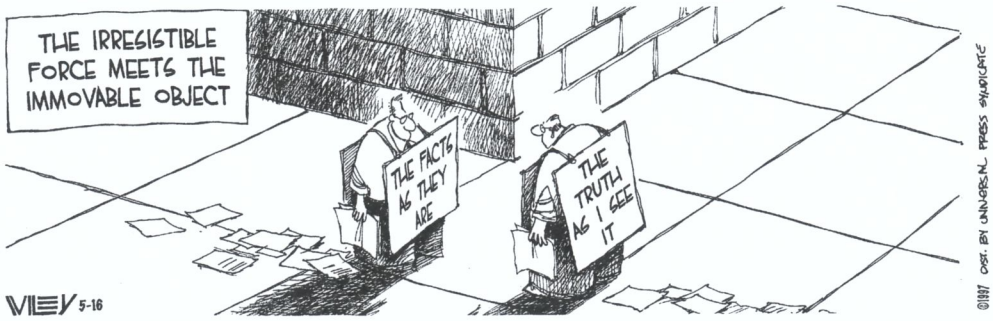
Aura seer: Of course.

Randi: Then if I were to step behind a wall barely taller than I am, you could determine my location from the aura visible above my head, right?

Randi once told me (DM) that no aura seer had agreed to take this simple test.

No matter how sensible-seeming or how wild an idea, the smart thinker asks: *Does it work?* When put to the test, can its predictions be confirmed? Subjected to such scrutiny, crazy-sounding ideas sometimes find support. During the 1700s, scientists scoffed at the notion that meteorites had extraterrestrial origins. When two Yale scientists challenged the conventional opinion, Thomas Jefferson reportedly jeered, "Gentlemen, I would rather believe that those two Yankee professors would lie than to believe that stones fell from Heaven." Sometimes scientific inquiry turns jeers into cheers.

More often, science becomes society's garbage collector, sending crazy-sounding ideas to the waste heap, atop previous claims of perpetual motion machines, miracle cancer cures, and out-of-body travels into centuries past. To sift reality from fantasy,



empirical approach an evidence-based method that draws on observation and experimentation.

critical thinking thinking that does not blindly accept arguments and conclusions. Rather, it examines assumptions, appraises the source, discerns hidden biases, evaluates evidence, and assesses conclusions.

sense from nonsense, requires a *scientific attitude*: being skeptical but not cynical, open but not gullible. When ideas compete, careful testing can reveal which ones best fit the facts. Can astrologers predict your future based on the planets' position at your birth? Is electroconvulsive therapy (delivering an electric shock to the brain) an effective treatment for severe depression? As we will see, putting such claims to the test has led psychological scientists to answer *No* to the first question and *Yes* to the second.

Putting a scientific attitude into practice requires not only curiosity and skepticism but also humility—an awareness of our own vulnerability to error and an openness to new perspectives. What matters is not my opinion or yours, but the truths revealed by our questioning and testing. If people or other animals don't behave as our ideas predict, then so much the worse for our ideas. This humble attitude was expressed in one of psychology's early mottos: "The rat is always right." (See Thinking Critically About: The Scientific Attitude.)

Critical Thinking

LOQ P-3 How does critical thinking feed a scientific attitude, and smarter thinking for everyday life?

The scientific attitude—curiosity + skepticism + humility—prepares us to think smarter. Smart thinking, called **critical thinking,** examines assumptions, appraises the source, discerns hidden biases, evaluates evidence, and assesses conclusions. Whether reading a research report or an online opinion, or listening to news or a talk show, critical thinkers ask questions: *How do they know that? What is this person's agenda? Is the conclusion based on anecdote, or on evidence? Does the evidence justify a cause-effect conclusion? What alternative explanations are possible?*

From a Twitter feed:
"The problem with quotes on the Internet is that you never know if they're true."
Abraham Lincoln

Critical thinkers wince when people make factual claims based on gut intuition: "I *feel like* climate change is [or isn't] happening." "I *feel like* self-driving cars are more [or less] dangerous." "I *feel like* my candidate is more honest." Such beliefs (commonly mislabeled as feelings) may or may not be true. Critical thinkers are open to the possibility that they might be wrong. Sometimes, the best evidence confirms our intuitions. Sometimes it challenges them, and beckons us to a different way of thinking.

Critical thinking, informed by science, helps clear the colored lenses of our biases. Consider: Does climate change threaten our future, and, if so, is it human-caused? In 2016, climate-action advocates interpreted record Louisiana flooding as evidence of climate change. In 2015, climate-change skeptics perceived North American bitter winter cold as discounting global warming. Rather than having their understanding of climate change swayed by such examples of today's weather, critical thinkers say, "Show me the evidence." Over time, is the Earth actually warming? Are the polar ice caps melting? Are vegetation patterns changing? And is human activity emitting atmospheric CO_2 that would lead us to expect such changes?

"The real purpose of the scientific method is to make sure Nature hasn't misled you into thinking you know something you don't actually know."
Robert M. Pirsig, *Zen and the Art of Motorcycle Maintenance*, 1974

When contemplating such issues, critical thinkers will also consider the credibility of sources. They will look at the evidence *(Do the facts support them, or are they just makin' stuff up?)*. They will recognize multiple perspectives. And they will expose themselves to news sources that challenge their preconceived ideas.

LOQ P-2 What are the three key elements of the scientific attitude, and how do they support scientific inquiry?

Thinking Critically About:

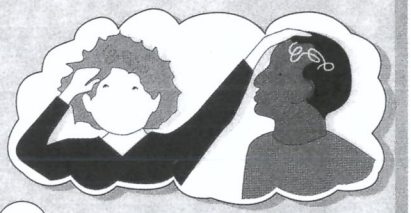
The Scientific Attitude

Three basic attitudes helped make modern science possible.

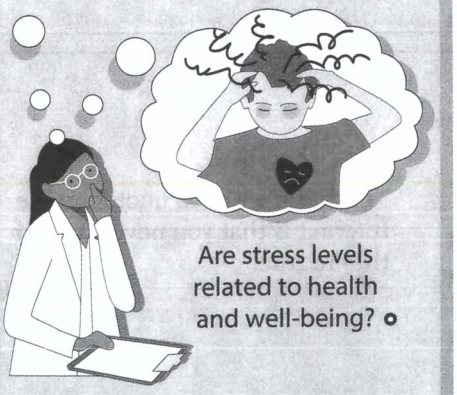
1 CURIOSITY:

Does it work?

When put to the test, can its predictions be confirmed?



Can some people read minds? ●



Are stress levels related to health and well-being? ○

● *No one has yet been able to demonstrate extrasensory mind-reading.*

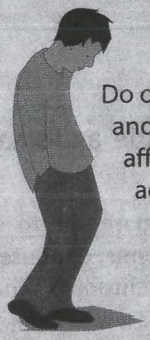
○ *Many studies have found that higher stress relates to poorer health.*

2 SKEPTICISM:

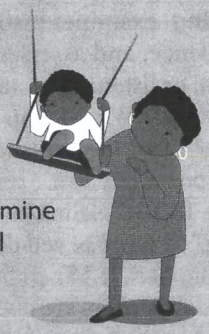
What do you mean?

How do you know?

Sifting reality from fantasy requires a healthy skepticism—an attitude that is not cynical (doubting everything), but also not gullible (believing everything).



Do our facial expressions and body postures affect how we actually feel? ○



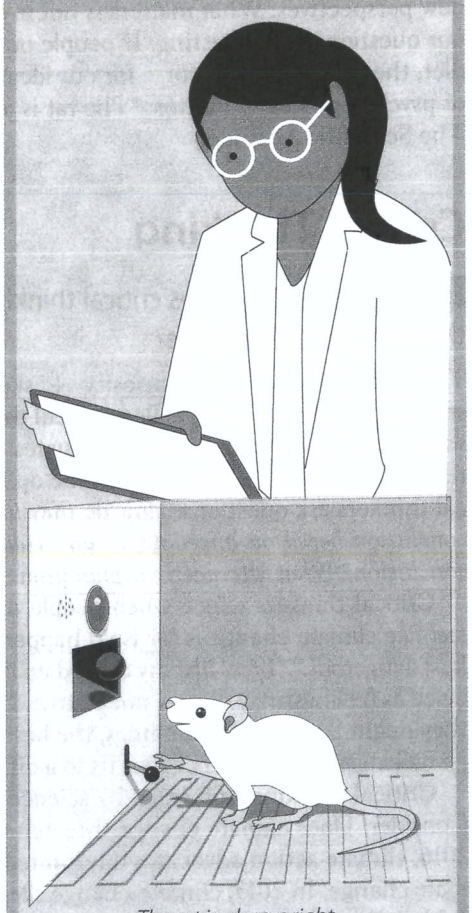
Do parental behaviors determine children's sexual orientation—or not? ●

○ *Our facial expressions and body postures can affect how we feel.*

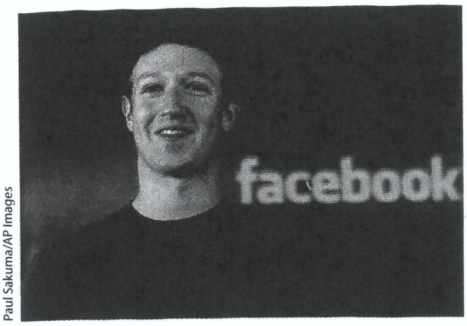
● *As you will see in Chapter 11, there is not a relationship between parental behaviors and a child's sexual orientation.*

3 HUMILITY:

Researchers must be willing to be surprised and follow new ideas. People and other animals don't always behave as our ideas and beliefs would predict.



The rat is always right.



Paul Sakuma/AP Images

Photos 12/Alamy

Life after studying psychology The study of psychology, and its critical thinking strategies, have helped prepare people for varied occupations, as illustrated by Facebook founder Mark Zuckerberg (who studied psychology and computer science while at Harvard) and Natalie Portman (who majored in psychology and co-authored a scientific article at Harvard—and on one of her summer breaks was filmed for *Star Wars: Episode I*).

Some religious people may view critical thinking and scientific inquiry, including psychology's, as a threat. Yet many of the leaders of the scientific revolution, including Copernicus and Newton, were deeply religious people acting on the idea that "in order to love and honor God, it is necessary to fully appreciate the wonders of his handiwork" (Stark, 2003a,b).

Critical inquiry can lead us to surprising findings. Some examples from psychological science: Massive losses of brain tissue early in life may have minimal long-term effects (see Chapter 2). Within days, newborns can recognize their mother by her odor (see Chapter 5). After brain damage, a person may be able to learn new skills yet be unaware of such learning (see Chapter 8). Diverse groups—men and women, old and young, rich and middle class, those with and without disabilities—report roughly comparable levels of personal happiness (see Chapter 12).

"My deeply held belief is that if a god anything like the traditional sort exists, our curiosity and intelligence are provided by such a god. We would be unappreciative of those gifts . . . if we suppressed our passion to explore the universe and ourselves."
Carl Sagan, *Broca's Brain*, 1979

As later chapters also illustrate, critical inquiry sometimes debunks popular presumptions. Sleepwalkers are *not* acting out their dreams (see Chapter 3). Our past experiences are *not* all recorded verbatim in our brains; with brain stimulation or hypnosis, one *cannot* simply replay and relive long-buried or repressed memories (see Chapter 8). Most people do *not* suffer from unrealistically low self-esteem, and high self-esteem is *not* all good (see Chapter 14). Opposites tend *not* to attract (see Chapter 13). In these instances and many others, what psychological scientists have learned is not what is widely believed.

Psychology's critical inquiry can also identify effective policies. To deter crime, should we invest money in lengthening prison sentences, or increase the likelihood of arrest? To help people recover from a trauma, should counselors help them relive it, or not? To increase voting, should we tell people about the low turnout problem, or emphasize that their peers are voting? What matters is not what we "feel" is true, but what *is* true. When put to critical thinking's test—and contrary to common practice—the second option in each of this paragraph's examples wins (Shafir, 2013).

Study Tip: Memory research reveals a *testing effect*: We retain information much better if we actively retrieve it by self-testing and rehearsing. (More on this at the end of this Prologue.) To bolster your learning and memory, take advantage of the *Retrieval Practice* opportunities you'll find throughout this text—with answers for checking at the base of each page or a click away in the e-book.

RETRIEVAL PRACTICE

RP-1 Describe what's involved in critical thinking.

Psychological Science Is Born

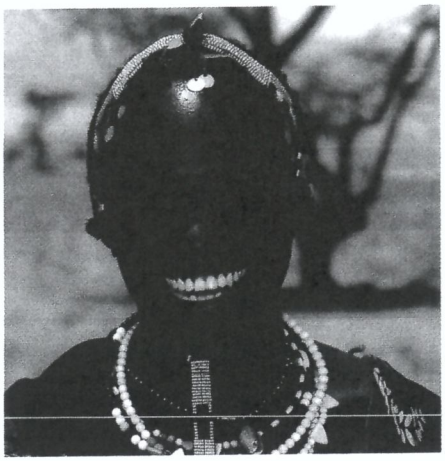
LOQ P-4 What were some important milestones in psychology's early development?

To be human is to be curious about ourselves and the world around us. Before 300 B.C.E., the Greek naturalist and philosopher Aristotle theorized about learning and memory, motivation and emotion, perception and personality. Today we chuckle at some of his guesses, like his suggestion that a meal makes us sleepy by causing gas and heat to collect around the source of our personality, the heart. But credit Aristotle with asking the right questions.

RETRIEVAL PRACTICE ANSWER

RP-1 Evaluating evidence, assessing conclusions, and examining our own assumptions are essential parts of critical thinking.

A smile is a smile the world around
This book tells the story of psychology as a global science, one that studies and celebrates cultural and gender similarities and differences. For example, cultural norms vary in when and how often people should smile, but a naturally happy smile *means* the same thing anywhere in the world.


Roy Toft/National Geographic/Getty Images


Antonia Brune

Throughout the book, information sources are cited in parentheses, with researchers' names and the date the research was published. Every citation can be found in the end-of-book References section, with complete documentation that follows American Psychological Association (APA) style.

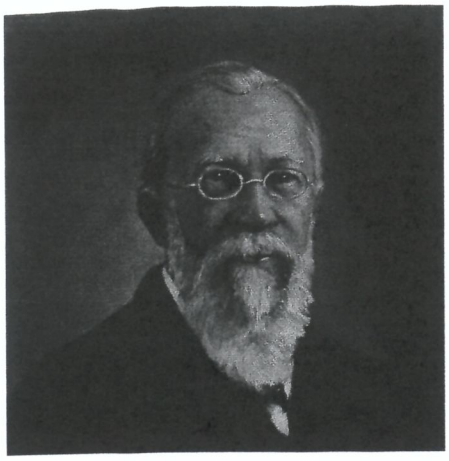
PSYCHOLOGY'S FIRST LABORATORY Philosophers' thinking about thinking continued until the birth of psychology as we know it. That happened on a December day in 1879, in a small, third-floor room at Germany's University of Leipzig. There, two young men were helping an austere, middle-aged professor, Wilhelm Wundt, create an experimental apparatus. Their machine measured how long it took for people to press a telegraph key after hearing a ball hit a platform (Hunt, 1993). Curiously, people responded in about one-tenth of a second when asked to press the key as soon as the sound occurred—and in about two-tenths of a second when asked to press the key as soon as they were consciously aware of perceiving the sound. (To be aware of one's awareness takes a little longer.) Wundt was seeking to measure "atoms of the mind"—the fastest and simplest mental processes. So began the first psychological laboratory, staffed by Wundt and psychology's first graduate students.

PSYCHOLOGY'S FIRST SCHOOLS OF THOUGHT Before long, this new science of psychology became organized into different branches, or schools of thought, each promoted by pioneering thinkers. Two early schools were **structuralism** and **functionalism**.

Structuralism As physicists and chemists discerned the structure of matter, so psychologist Edward Bradford Titchener aimed to discover the mind's structure. He engaged people in self-reflective *introspection* (looking inward), training them to report elements of their experience as they looked at a rose, listened to a metronome, smelled a scent, or tasted a substance. What were their immediate sensations, their images, their feelings? And how did these relate to one another? Alas, structuralism's technique of introspection proved somewhat unreliable. It required smart, verbal people, and its results varied from person to person and experience to experience. As introspection waned, so did structuralism. Hoping to assemble the mind's structure from simple elements was rather like trying to understand a car by examining its disconnected parts.

Functionalism Philosopher-psychologist William James thought it would be more fruitful to consider the evolved functions of our thoughts and feelings. Smelling is what the nose does; thinking is what the brain does. But *why* do the nose and brain do these things? Under the influence of evolutionary theorist Charles Darwin, James assumed that thinking, like smelling, developed because it was *adaptive*—it helped our ancestors survive and reproduce. Consciousness serves a function. It enables us to consider our past, adjust to our present, and plan our future. To explore the mind's adaptive functions, James studied down-to-earth emotions, memories, willpower, habits, and moment-to-moment streams of consciousness.

James' writings moved the publisher Henry Holt to offer James a contract for a textbook on the new science of psychology. James agreed and began work in 1878, with an apology for requesting two years to finish his writing. The text proved an unexpected chore and actually took him 12 years. (Why are we not surprised?) More than a century later, people still read the resulting *Principles of Psychology* (1890) and marvel at the brilliance and elegance with which James introduced psychology to the educated public.



Wilhelm Wundt (1832–1920) Wundt established the first psychology laboratory at the University of Leipzig, Germany.

Edward Bradford Titchener (1867–1927) Titchener used introspection to search for the mind's structural elements.

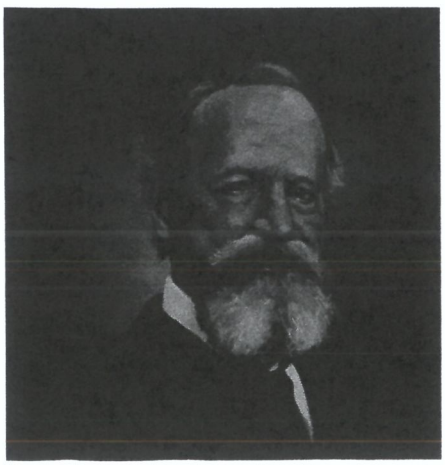
structuralism early school of thought promoted by Wundt and Titchener; used introspection to reveal the structure of the human mind.

functionalism early school of thought promoted by James and influenced by Darwin; explored how mental and behavioral processes function—how they enable the organism to adapt, survive, and flourish.

PSYCHOLOGY'S FIRST WOMEN James' legacy stems from his Harvard mentoring as well as from his writing. In 1890, thirty years before American women had the right to vote, he admitted Mary Whiton Calkins into his graduate seminar—over the objections of Harvard's president (Scarborough & Furumoto, 1987). When Calkins joined, the other students (all men) dropped out. So James tutored her alone. Later, she finished all of Harvard's Ph.D. requirements, outscoring all the male students on the qualifying exams. Alas, Harvard denied her the degree she had earned, offering her instead a degree from Radcliffe College, its undergraduate "sister" school for women. Calkins resisted the unequal treatment and refused the degree. She nevertheless went on to become a distinguished memory researcher and in 1905 became the American Psychological Association's (APA's) first female president.

The honor of being the first official female psychology Ph.D. later fell to Margaret Floy Washburn, who also wrote an influential book, *The Animal Mind*, and became the second female APA president in 1921. But Washburn's gender barred doors for her, too. Although her thesis was the first foreign study Wundt published in his psychology journal, she could not join the all-male organization of experimental psychologists founded by Titchener, her own graduate adviser (Johnson, 1997). What a different world from the recent past—1997 to 2017—when women were 10 of the 20 elected presidents of the science-oriented Association for Psychological Science. In the United States, Canada, and Europe, most psychology doctorates are now earned by women.

Margaret Floy Washburn (1871–1939) The first woman to receive a psychology Ph.D., Washburn synthesized animal behavior research in *The Animal Mind* (1908).



William James (1842–1910) and Mary Whiton Calkins (1863–1930) James was a legendary teacher-writer who authored an important 1890 psychology text. He mentored Calkins, who became a pioneering memory researcher and the first woman to be president of the American Psychological Association.

RETRIEVAL PRACTICE

RP-2 What event defined the start of scientific psychology?

RP-3 Why did introspection fail as a method for understanding how the mind works?

RP-4 The school of _____ used introspection to define the mind's makeup; _____ focused on how mental processes enable us to adapt, survive, and flourish.

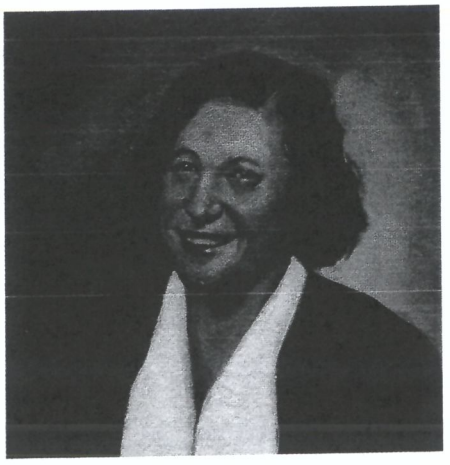
Psychological Science Develops

LOQ P-5 How did behaviorism, Freudian psychology, and humanistic psychology further the development of psychological science?

In psychology's early days, many psychologists shared with the English essayist C. S. Lewis the view that "there is one thing, and only one in the whole universe which we know more about than we could learn from external observation." That one thing, Lewis said, is ourselves. "We have, so to speak, inside information" (1960, pp. 18–19). Wundt and Titchener focused on inner sensations, images, and feelings. James also engaged in introspective examination of the stream of consciousness and of emotion. For these and other early pioneers, *psychology* was defined as "the science of mental life."

BEHAVIORISM That definition endured until the 1920s, when the first of two provocative American psychologists appeared on the scene. John B. Watson, and later B. F. Skinner, dismissed introspection and redefined *psychology* as "the scientific study of observable behavior." After all, they said, science is rooted in observation: What you cannot observe and measure, you cannot scientifically study. You cannot observe a sensation, a feeling, or a thought, but you *can* observe and record people's *behavior* as they are *conditioned*—as they respond to and learn in different situations. Many agreed, and **behaviorism** was one of two major forces in psychology well into the 1960s.

FREUDIAN PSYCHOLOGY The other major force was *Freudian psychology*, which emphasized the ways our unconscious mind and childhood experiences affect our behavior. (In chapters to come, we'll look more closely at Sigmund Freud's teachings, including his theory of personality, his views on unconscious sexual conflicts, and the mind's defenses against its own wishes and impulses.)

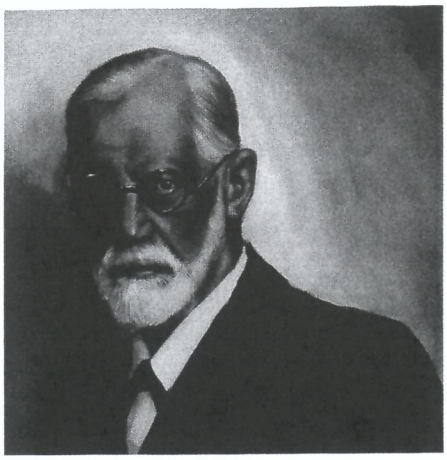


John B. Watson (1878–1958) and Rosalie Rayner (1898–1935) Working with Rayner, Watson championed psychology as the scientific study of behavior. In a controversial study on a baby who became famous as "Little Albert," he and Rayner showed that fear could be learned.

RETRIEVAL PRACTICE ANSWERS

RP-2 Scientific psychology began in Germany in 1879 when Wilhelm Wundt opened the first psychology laboratory.
RP-3 People's self-reports varied, depending on the experience and the person's intelligence and verbal ability.
RP-4 structuralism; functionalism

B. F. Skinner (1904–1990) This leading behaviorist rejected introspection and studied how consequences shape behavior.



Sigmund Freud (1856–1939) The controversial ideas of this famed personality theorist and therapist have influenced humanity's self-understanding.

HUMANISTIC PSYCHOLOGY As the behaviorists had rejected the early 1900's definition of *psychology*, other groups rejected the behaviorist definition. In the 1960s, **humanistic psychologists**, led by Carl Rogers and Abraham Maslow, found both behaviorism and Freudian psychology too limiting. Rather than focusing on conditioned responses or childhood memories, the humanistic psychologists focused on our needs for love and acceptance and on environments that nurture or limit personal growth.

RETRIEVAL PRACTICE

RP-5 From the 1920s through the 1960s, the two major forces in psychology were _____ and _____ psychology.

Contemporary Psychology

LOQ P-6 How has contemporary psychology focused on cognition, on biology and experience, on culture and gender, and on human flourishing?

Psychologists in the 1960s pioneered a *cognitive revolution*, leading the field back to its early interest in how our mind processes and retains information. **Cognitive psychology** today continues its scientific exploration of how we perceive, process, and remember information, and of how thinking and emotion interact in anxiety, depression, and other disorders. The marriage of cognitive psychology (the science of mind) and neuroscience (the science of brain) gave birth to **cognitive neuroscience**. This specialty, with researchers in many disciplines, studies the brain activity underlying mental activity.

Today's psychology builds on the work of many earlier scientists and schools of thought. To encompass psychology's concern with observable behavior *and* with inner thoughts and feelings, we now define **psychology** as the *science of behavior and mental processes*. Let's unpack this definition. *Behavior* is anything an organism *does*—any action we can observe and record. Yelling, smiling, blinking, sweating, talking, and questionnaire marking are all observable behaviors. *Mental processes* are the internal, subjective experiences we infer from behavior—sensations, perceptions, dreams, thoughts, beliefs, and feelings.

RETRIEVAL PRACTICE ANSWER

RP-5 behaviorism; Freudian

behaviorism the view that psychology (1) should be an objective science that (2) studies behavior without reference to mental processes. Most psychologists today agree with (1) but not with (2).

humanistic psychology historically significant perspective that emphasized human growth potential.

cognitive psychology the study of mental processes, such as occur when we perceive, learn, remember, think, communicate, and solve problems.

cognitive neuroscience the interdisciplinary study of the brain activity linked with cognition (including perception, thinking, memory, and language).

psychology the science of behavior and mental processes.

nature–nurture issue the longstanding controversy over the relative contributions that genes and experience make to the development of psychological traits and behaviors. Today's science sees traits and behaviors arising from the interaction of nature and nurture.

natural selection the principle that inherited traits that better enable an organism to survive and reproduce in a particular environment will (in competition with other trait variations) most likely be passed on to succeeding generations.

evolutionary psychology the study of the evolution of behavior and the mind, using principles of natural selection.

behavior genetics the study of the relative power and limits of genetic and environmental influences on behavior.

The key word in psychology's definition is *science*. Psychology is less a set of findings than a way of asking and answering questions. Our aim, then, is not merely to report results but also to show you how psychologists play their game. You will see how researchers evaluate conflicting opinions and ideas. And you will learn how all of us, whether scientists or simply curious people, can think smarter when experiencing and explaining the events of our lives.

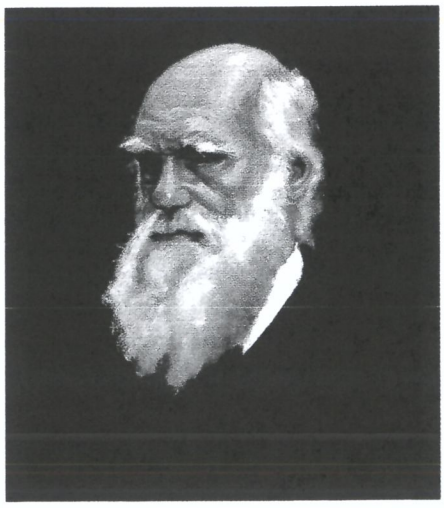
Psychology has roots in many disciplines and countries. The young science of psychology developed from the more established fields of philosophy and biology. Wundt was both a philosopher and a physiologist. James was an American philosopher. Freud was an Austrian physician. Ivan Pavlov, who pioneered the study of learning, was a Russian physiologist. Jean Piaget, the last century's most influential observer of children, was a Swiss biologist. These "Magellans of the mind," as psychology historian Morton Hunt (1993) called them, illustrate the diversity of psychology's origins.

Like those pioneers, today's estimated 1+ million psychologists are citizens of many lands (Zoma & Gielen, 2015). The International Union of Psychological Science has 82 member nations, from Albania to Zimbabwe. In China, the first university psychology department was established in 1978; by 2016 there were some 270 (Zhang, 2016). Moreover, thanks to international publications, joint meetings, and the Internet, collaboration and communication cross borders more than ever. Psychology is *growing* and it is *globalizing*. The story of psychology—the subject of this book—continues to develop in many places, at many levels, with interests ranging from the study of nerve cell activity to the study of international conflicts. Contemporary psychology, shaped by many forces, is particularly influenced by our understanding of biology and experience, culture and gender, and human flourishing.

Evolutionary Psychology and Behavior Genetics

Are our human traits inherited, or do they develop through experience? This has been psychology's biggest and most persistent issue. But the debate over the **nature–nurture issue** is ancient. The Greek philosopher Plato (428–348 B.C.E.) assumed that we inherit character and intelligence and that certain ideas are inborn. Aristotle (384–322 B.C.E.) countered that there is nothing in the mind that does not first come in from the external world through the senses.

In the 1600s, European philosophers rekindled the debate. John Locke argued that the mind is a blank slate on which experience writes. René Descartes disagreed, believing that some ideas are innate. Descartes' views gained support from a curious naturalist two centuries later. In 1831, an indifferent student but ardent collector of beetles, mollusks, and shells set sail on a historic round-the-world journey. The 22-year-old voyager, Charles Darwin, pondered the incredible species variation he encountered, including tortoises on one island that differed from those on nearby islands. Darwin's 1859 *On the Origin of Species* explained this diversity by proposing the evolutionary process of **natural selection:** From among chance variations, nature selects traits that best enable an organism to survive and reproduce in a particular environment. Darwin's principle of natural selection—what philosopher Daniel Dennett (1996) has called "the single best idea anyone has ever had"—is still with us 150+ years later as biology's organizing principle. Evolution also has become an important principle for twenty-first-century psychology. This would surely have pleased Darwin, who believed his theory explained not only animal structures (such as a polar bear's white coat) but also animal behaviors (such as the emotional expressions associated with human lust and rage).



Charles Darwin (1809–1882) Darwin argued that natural selection shapes behaviors as well as bodies.

The nature–nurture issue recurs throughout this text as today's psychologists explore the relative contributions of biology and experience. They ask, for example, how are we humans *alike* because of our common biology and evolutionary history? That's the focus of **evolutionary psychology.** And how do we individually *differ* because of our differing genes and environments? That's the focus of **behavior genetics.**

We can, for example, ask: Are gender differences biologically predisposed or socially constructed? Is children's grammar mostly innate or formed by experience? How are

intelligence and personality differences influenced by heredity and by environment? Are sexual behaviors more "pushed" by inner biology or "pulled" by external incentives? Should we treat psychological disorders—depression, for example—as disorders of the brain, disorders of thought, or both?

Such debates continue. Yet over and again we will see that in contemporary science the nature–nurture tension dissolves: *Nurture works on what nature provides.* Our species is biologically endowed with an enormous capacity to learn and adapt. Moreover, every psychological event (every thought, every emotion) is simultaneously a biological event. Thus, depression can be both a brain disorder *and* a thought disorder.

rubberball/Getty Images

© Tony Freeman/PhotoEdit – All rights reserved.

A nature-made nature–nurture experiment Identical twins (left) have the same genes. This makes them ideal participants in studies designed to shed light on hereditary and environmental influences on personality, intelligence, and other traits. Fraternal twins (right) have different genes but often share a similar environment. Twin studies provide a wealth of findings—described in later chapters—showing the importance of both nature and nurture.

RETRIEVAL PRACTICE

RP-6 How did the cognitive revolution affect the field of psychology?

RP-7 What is natural selection?

RP-8 What is contemporary psychology's position on the nature–nurture issue?

Cross-Cultural and Gender Psychology

What can we learn about people in general from psychological studies done in one time and place—often with participants from what psychologists have called the WEIRD cultures (*W*estern, *E*ducated, *I*ndustrialized, *R*ich, and *D*emocratic [Henrich et al., 2010])? As we will see time and again, **culture**—shared ideas and behaviors that one generation passes on to the next—matters. Our culture shapes our behavior. It influences our standards of promptness and frankness, our attitudes toward premarital sex and varying body shapes, our tendency to be casual or formal, our willingness to make eye contact, our conversational distance, and much, much more. Being aware of such differences, we can restrain our assumptions that others will think and act as we do.

"All people are the same; only their habits differ."

Confucius, 551–479 B.C.E.

It is also true, however, that our shared biological heritage unites us as a universal human family. The same underlying processes guide people everywhere. Some examples:

- People diagnosed with *specific learning disorder* (formerly called dyslexia) exhibit the same brain malfunction whether they are Italian, French, or British (Paulesu et al., 2001).
- Variation in languages may impede communication across cultures. Yet all languages share deep principles of grammar, and people from opposite hemispheres can communicate with a smile or a frown.
- People in different cultures vary in feelings of loneliness (Lykes & Kemmelmeier, 2014). But across cultures, loneliness is magnified by shyness, low self-esteem, and being unmarried (Jones et al., 1985; Rokach et al., 2002).

We are each in certain respects like all others, like some others, and like no other. Studying people of all races and cultures helps us discern our similarities and our differences, our human kinship and our diversity.

You will see throughout this book that one's socially defined *gender* (as well as one's biologically defined sex) matters, too. Today's researchers report gender differences in what we dream, in how we express and detect emotions, and in our risk for alcohol

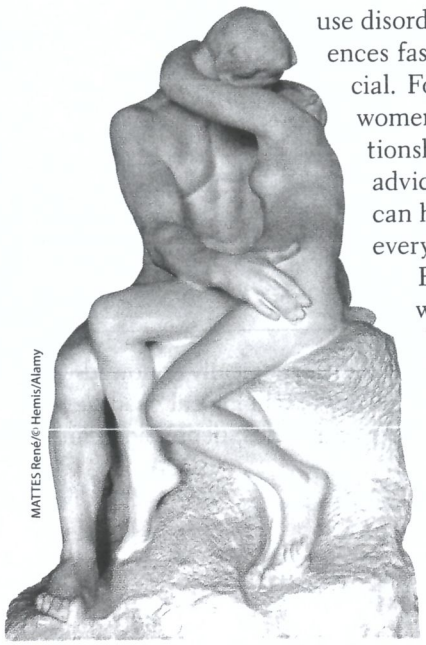
culture the enduring behaviors, ideas, attitudes, values, and traditions shared by a group of people and transmitted from one generation to the next.

RETRIEVAL PRACTICE ANSWERS

RP-6 It recaptured the field's early interest in mental processes and made them legitimate topics for scientific study. **RP-7** This is the process by which nature selects from chance variations the traits that best enable an organism to survive and reproduce in a particular environment. **RP-8** Psychological events stem from the interaction of nature and nurture, rather than from either of them acting alone.

Mark Cuthbert/UK Press/Getty Images

Culture and kissing Kissing crosses cultures. Yet how we do it varies. Imagine yourself kissing someone on the lips. Do you tilt your head right or left? In Western cultures, in which people read from left to right, about two-thirds of couples kiss right, as in William and Kate's famous kiss, and in Auguste Rodin's sculpture, *The Kiss* In one study, 77 percent of Hebrew- and Arabic-language right-to-left readers kissed tilting left (Shaki, 2013).



MATTES René/© Hemis/Alamy

use disorder, depression, and eating disorders. Gender differences fascinate us, and studying them is potentially beneficial. For example, many researchers have observed that women carry on conversations more readily to build relationships, while men talk more to give information and advice (Tannen, 2001). Understanding these differences can help us prevent conflicts and misunderstandings in everyday interactions.

But again, psychologically as well as biologically, women and men are overwhelmingly similar. Whether female or male, we learn to walk at about the same age. We experience the same sensations of light and sound. We remember vivid emotional events and forget mundane details. We feel the same pangs of hunger, desire, and fear. We exhibit similar overall intelligence and well-being.

The point to remember: Even when specific attitudes and behaviors vary by gender or across cultures, as they often do, the underlying processes are much the same.

Positive Psychology

Psychology's first hundred years often focused on understanding and treating troubles, such as abuse and anxiety, depression and disease, prejudice and poverty. Much of today's psychology continues the exploration of such challenges. Without slighting the need to repair damage and cure disease, Martin Seligman and others (2002, 2005, 2011) have called for more research on *human flourishing.* These psychologists call their approach **positive psychology.** They believe that happiness is a by-product of a pleasant, engaged, and meaningful life. Thus, positive psychology uses scientific methods to explore the building of a "good life" that engages our skills, and a "meaningful life" that points beyond ourselves.

Our online learning tools will help you excel in this course. Take advantage of self-tests, interactive simulations, Immersive Learning "How Would You Know?" activities, and "Assess Your Strengths" personal self-assessments. See LaunchPadWorks.com for more information.

Psychology's Three Main Levels of Analysis

LOQ P-7 What are psychology's levels of analysis and related perspectives?

Each of us is a complex system that is part of a larger social system. But each of us is also composed of smaller systems, such as our nervous system and body organs, which are composed of still smaller systems—cells, molecules, and atoms.

These tiered systems suggest different **levels of analysis,** which offer complementary outlooks. It's like explaining horrific school shootings. Is it because the shooters have brain disorders or genetic tendencies that cause them to be violent? Because they have observed brutality and mayhem in the media or played violent video games? Because they live in a gun-toting society? Such perspectives are complementary because "everything is related to everything else" (Brewer, 1996). Together, different levels of analysis form an integrated **biopsychosocial approach,** which considers the influences of biological, psychological, and social-cultural factors (**FIGURE 1**).

Each level of analysis offers a perspective for looking at a behavior or mental process, yet each by itself is incomplete. Each perspective described in **TABLE 1** asks different questions and has its limits. Together they complement one another. Consider, for example, how they shed light on anger:

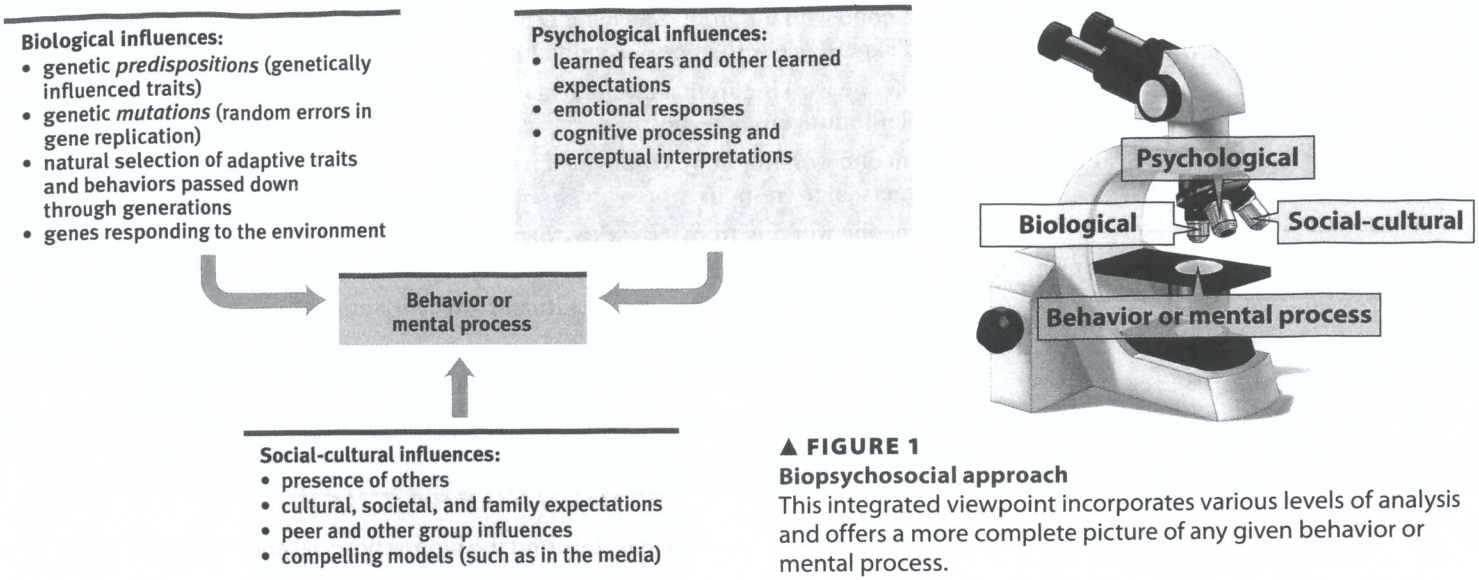
- Someone working from a *neuroscience perspective* might study brain circuits that cause us to be red in the face and "hot under the collar."
- Someone working from an *evolutionary perspective* might analyze how anger facilitated the survival of our ancestors' genes.

For an excellent tour of psychology's roots, view the 9.5-minute **Video: The History of Psychology**.

positive psychology the scientific study of human flourishing, with the goals of discovering and promoting strengths and virtues that help individuals and communities to thrive.

levels of analysis the differing complementary views, from biological to psychological to social-cultural, for analyzing any given phenomenon.

biopsychosocial approach an integrated approach that incorporates biological, psychological, and social-cultural levels of analysis.



▲ FIGURE 1
Biopsychosocial approach
This integrated viewpoint incorporates various levels of analysis and offers a more complete picture of any given behavior or mental process.

TABLE 1
Psychology's Current Perspectives

Perspective	Focus	Sample Questions	Examples of Subfields Using This Perspective
Neuroscience	How the body and brain enable emotions, memories, and sensory experiences	How do pain messages travel from the hand to the brain? How is blood chemistry linked with moods and motives?	Biological; cognitive; clinical
Evolutionary	How the natural selection of traits has promoted the survival of genes	How does evolution influence behavior tendencies?	Biological; developmental; social
Behavior genetics	How our genes and our environment influence our individual differences	To what extent are psychological traits such as intelligence, personality, sexual orientation, and vulnerability to depression products of our genes? Of our environment?	Personality; developmental; legal/forensic
Psychodynamic	How behavior springs from unconscious drives and conflicts	How can someone's personality traits and disorders be explained by unfulfilled wishes and childhood traumas?	Clinical; counseling; personality
Behavioral	How we learn observable responses	How do we learn to fear particular objects or situations? What is the most effective way to alter our behavior, say, to lose weight or stop smoking?	Clinical; counseling; industrial-organizational
Cognitive	How we encode, process, store, and retrieve information	How do we use information in remembering? Reasoning? Solving problems?	Cognitive neuroscience; clinical; counseling; industrial-organizational
Social-cultural	How behavior and thinking vary across situations and cultures	How are we affected by the people around us, and by our surrounding culture?	Developmental; social; clinical; counseling

JUERGEN SCHWARZ/AFP/Getty Images

- Someone working from a *behavior genetics perspective* might study how heredity and experience influence our individual differences in temperament.
- Someone working from a *psychodynamic perspective* might view an outburst as an outlet for unconscious hostility.
- Someone working from a *behavioral perspective* might attempt to determine what triggers angry responses or aggressive acts.
- Someone working from a *cognitive perspective* might study how our interpretation of a situation affects our anger and how our anger affects our thinking.
- Someone working from a *social-cultural perspective* might explore how expressions of anger vary across cultural contexts.

The point to remember: Like two-dimensional views of a three-dimensional object, each of psychology's perspectives is helpful. But each by itself fails to reveal the whole picture.

RETRIEVAL PRACTICE

RP-9 What advantage do we gain by using the biopsychosocial approach in studying psychological events?

RP-10 The _____-_____ perspective in psychology focuses on how behavior and thought differ from situation to situation and from culture to culture, while the _____ perspective emphasizes observation of how we respond to and learn in different situations.

Psychology's Subfields

LOQ P-8 What are psychology's main subfields?

Picturing a chemist at work, you may envision a laboratory scientist surrounded by test tubes and high-tech equipment. Picture a psychologist at work and you would be right to envision

- a white-coated scientist probing a rat's brain.
- an intelligence researcher measuring how quickly an infant shows boredom by looking away from a familiar picture.
- an executive evaluating a new "healthy lifestyles" training program for employees.
- a researcher at a computer analyzing "big data" from Twitter or Facebook status updates.
- a therapist actively listening to a depressed client's thoughts.
- a traveling academic visiting another culture and collecting data on variations in human values and behaviors.
- a teacher or writer sharing the joy of psychology with others.

The cluster of subfields we call psychology is a meeting ground for different disciplines. "Psychology is a hub scientific discipline," said Association for Psychological Science past-president John Cacioppo (2007). Thus, it's a perfect home for those with wide-ranging interests. In its diverse activities, from biological experimentation to cultural comparisons, the tribe of psychology is united by a common quest: *describing and explaining behavior and the mind underlying it.*

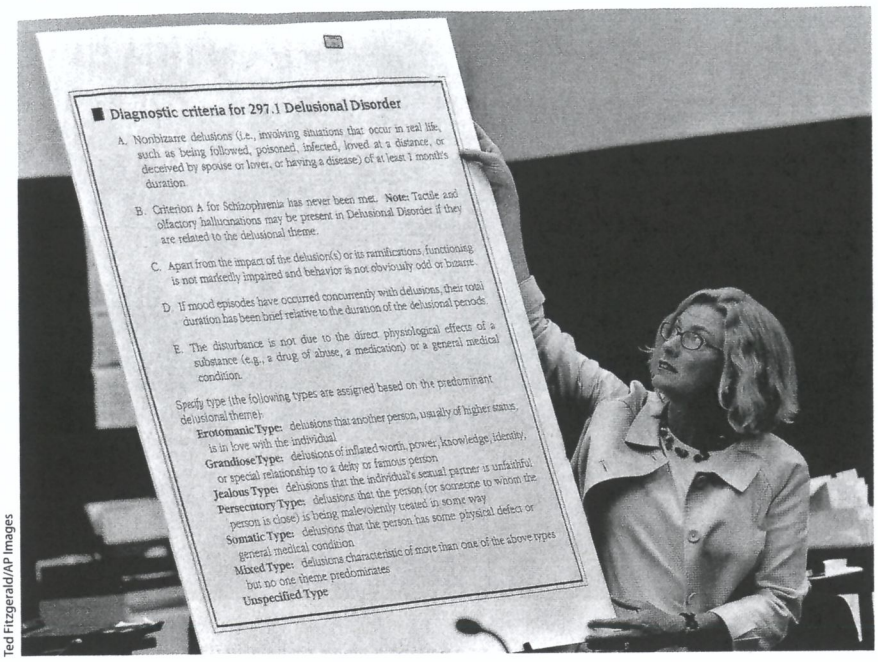
Some psychologists conduct **basic research** that builds psychology's knowledge base. We will meet a wide variety of such researchers, including *biological psychologists* exploring the links between body and mind; *developmental psychologists* studying

The New Yorker Collection, 1986, J.B. Handelsman from cartoonbank.com

"I'm a social scientist, Michael. That means I can't explain electricity or anything like that, but if you ever want to know about people I'm your man."

RETRIEVAL PRACTICE ANSWERS

RP-9 By incorporating three different levels of analysis, the biopsychosocial approach can provide a more complete view than any one perspective could offer. **RP-10** social-cultural; behavioral



Ted Fitzgerald/AP Images

Image Source/Getty Images

Psychology in court Forensic psychologists apply psychology's principles and methods in the criminal justice system. They may assess witness credibility or testify in court on a defendant's state of mind and future risk.

our changing abilities from womb to tomb; *cognitive psychologists* experimenting with how we perceive, think, and solve problems; *personality psychologists* investigating our persistent traits; and *social psychologists* exploring how we view and affect one another.

These and other psychologists also may conduct **applied research,** tackling practical problems. *Industrial-organizational psychologists,* for example, use psychology's concepts and methods in the workplace to help organizations and companies select and train employees, boost morale and productivity, design products, and implement systems.

Psychology is a science, but also a profession that helps people have healthier relationships, overcome anxiety or depression, and raise thriving children. **Counseling psychologists** help people to cope with challenges and crises (including academic, vocational, and relationship issues) and to improve their personal and social functioning. **Clinical psychologists** assess and treat people with mental, emotional, and behavior disorders. Both counseling and clinical psychologists administer and interpret tests, provide counseling and therapy, and sometimes conduct basic and applied research. By contrast, **psychiatrists,** who also may provide psychotherapy, are medical doctors licensed to prescribe drugs and otherwise treat physical causes of psychological disorders.

Rather than seeking to change people to fit their environment, **community psychologists** work to create social and physical environments that are healthy for all (Bradshaw et al., 2009; Trickett, 2009). To prevent bullying, they might consider ways to improve the culture of the school and neighborhood, and how to increase bystander intervention (Polanin et al., 2012).

With perspectives ranging from the biological to the social, and with settings ranging from the laboratory to the clinic to the office, psychology relates to many fields. Psychologists teach in medical schools, business schools, law schools, and theological seminaries, and they work in hospitals, factories, and corporate offices. They engage in interdisciplinary studies, such as psychohistory (the study of people's historical motivations), psycholinguistics (the study of language and thinking), and psychoceramics (the study of crackpots).[1]

basic research pure science that aims to increase the scientific knowledge base.

applied research scientific study that aims to solve practical problems.

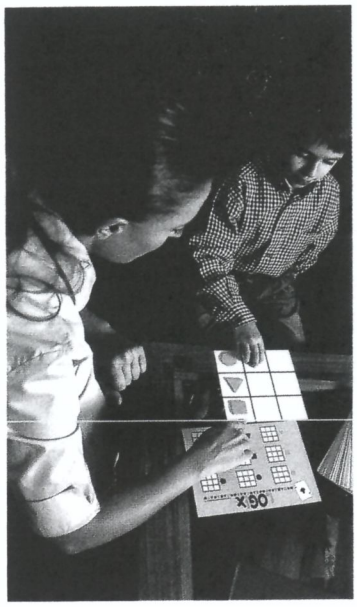
counseling psychology a branch of psychology that assists people with problems in living (often related to school, work, or marriage) and in achieving greater well-being.

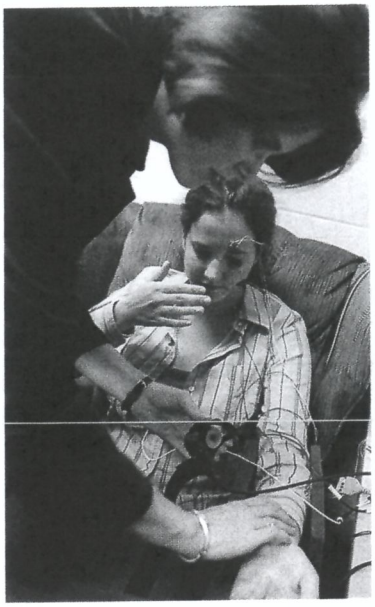
clinical psychology a branch of psychology that studies, assesses, and treats people with psychological disorders.

psychiatry a branch of medicine dealing with psychological disorders; practiced by physicians who are licensed to provide medical (for example, drug) treatments as well as psychological therapy.

community psychology a branch of psychology that studies how people interact with their social environments and how social institutions affect individuals and groups.

[1] Confession: I [DM] wrote the last part of this sentence on April Fool's Day.





Psychology: A science and a profession Psychologists experiment with, observe, test, and help modify behavior. Here we see psychologists testing a child, measuring emotion-related physiology, and doing face-to-face therapy.

Want to learn more? See Appendix B, Career Fields in Psychology, at the end of this book, and go to the online ***Pursuing a Psychology Career*** resource to learn about the many interesting options available to those with bachelor's, master's, and doctoral degrees in psychology. To review and test your understanding of psychology's perspectives and subfields, engage online with **Concept Practice: Psychology's Current Perspectives** and **Concept Practice: Psychology's Subfields**.

"Once expanded to the dimensions of a larger idea, [the mind] never returns to its original size."
Oliver Wendell Holmes, 1809–1894

Psychology also influences modern culture. Knowledge transforms us. Learning about the solar system and the germ theory of disease alters the way people think and act. Learning about psychology's findings also changes people: They less often judge psychological disorders as moral failings, treatable by punishment and ostracism. They less often regard and treat women as men's mental inferiors. They less often view and raise children as ignorant, willful beasts in need of taming. "In each case," noted Morton Hunt (1990, p. 206), "knowledge has modified attitudes, and, through them, behavior." Once aware of psychology's well-researched ideas—about how body and mind connect, how a child's mind grows, how we construct our perceptions, how we learn and remember, how people across the world are alike (and different)—your mind may never again be quite the same.

But bear in mind psychology's limits. Don't expect it to answer the ultimate questions, such as those posed by Russian novelist Leo Tolstoy (1904): "Why should I live? Why should I do anything? Is there in life any purpose which the inevitable death that awaits me does not undo and destroy?"

"I have uttered what I did not understand, things too wonderful for me."
Job 42:3

Although many of life's significant questions are beyond psychology, some very important ones are illuminated by even a first psychology course. Through painstaking research, psychologists have gained insights into brain and mind, dreams and memories, depression and joy. Even the unanswered questions can renew our sense of mystery about things we do not yet understand. Moreover, your study of psychology can help teach you how to ask and answer important questions—how to think critically as you evaluate competing ideas and claims.

Psychology deepens our appreciation for how we humans perceive, think, feel, and act. By so doing it can enrich our lives and enlarge our vision. Through this book we hope to help guide you toward that end. As educator Charles Eliot said a century ago: "Books are the quietest and most constant of friends, and the most patient of teachers."

RETRIEVAL PRACTICE

RP-11 Match the specialty on the left with the description on the right.

1.	Clinical psychology	a.	Works to create social and physical environments that are healthy for all.
2.	Psychiatry	b.	Studies, assesses, and treats people with psychological disorders but usually does not provide medical therapy.
3.	Community psychology	c.	Branch of medicine dealing with psychological disorders.

Use Psychology to Become a Stronger Person—and a Better Student

LOQ P-9 How can psychological principles help you learn, remember, and thrive?

Throughout this text, we will offer evidence-based suggestions that you can use to live a happy, effective, flourishing life, including the following:

- *Get a full night's sleep.* Unlike sleep-deprived people, who live with fatigue and gloomy moods, well-rested people live with greater energy, alertness, and productivity.
- *Make space for exercise.* Aerobic activity not only increases health and energy, it also is an effective remedy for mild to moderate depression and anxiety.
- *Set long-term goals, with daily aims.* Successful people take time each day to work toward their goals, such as exercising, sleeping more, or eating more healthfully. Over time, they often find that their daily practice becomes a habit.
- *Have a "growth mindset."* Rather than seeing their abilities as fixed, successful people view their mental abilities as like a muscle—something that grows stronger with effortful use.
- *Prioritize relationships.* We humans are social animals. We flourish when connected in close relationships. We are both happier and healthier when supported by (and supporting) caring friends.

Psychology's research also shows how we can learn and retain information. Many students assume that the way to cement new learning is to reread. What helps even more—and what this book therefore encourages—is repeated self-testing and rehearsal of previously studied material. Memory researchers Henry Roediger and Jeffrey Karpicke (2006) call this phenomenon the **testing effect**. (It is also sometimes called the *retrieval practice effect* or *test-enhanced learning.*) They note that "testing is a powerful means of improving learning, not just assessing it." In one of their studies, English-speaking students recalled the meaning of 40 previously learned Swahili words much better if tested repeatedly than if they spent the same time restudying the words (Karpicke & Roediger, 2008). Many other studies, including in college classrooms, confirm that *frequent quizzing and self-testing boosts students' retention* (McDaniel et al., 2015; Trumbo et al., 2016).

As you will see in Chapter 8, to master information you must *actively process it.* Your mind is not like your stomach, something to be filled passively; it grows stronger only with effort. Countless experiments reveal that people learn and remember best when they put material in their own words, rehearse it, and then retrieve and review it again.

testing effect enhanced memory after retrieving, rather than simply rereading, information. Also referred to as a *retrieval practice effect* or *test-enhanced learning.*

"If you read a piece of text through twenty times, you will not learn it by heart so easily as if you read it ten times while attempting to recite it from time to time and consulting the text when your memory fails."
Francis Bacon, *Novum Organum*, 1620

RETRIEVAL PRACTICE ANSWERS

RP-11 1. b, 2. c, 3. a

SQ3R a study method incorporating five steps: *S*urvey, *Q*uestion, *R*ead, *R*etrieve, *R*eview.

The **SQ3R** study method incorporates these principles (McDaniel et al., 2009; Robinson, 1970). SQ3R is an acronym for its five steps: *S*urvey, *Q*uestion, *R*ead, *R*etrieve,[2] *R*eview.

To study a chapter, first *survey*, taking a bird's-eye view. Scan the table of contents on the chapter's first page, and notice the organization.

Before you read each main section, try to answer its numbered Learning Objective *Question* (for this section: "How can psychological principles help you learn, remember, and thrive?"). Roediger and Bridgid Finn (2010) have found that "trying and failing to retrieve the answer is actually helpful to learning." Those who test their understanding *before* reading, and discover what they don't yet know, will learn and remember better.

Then *read*, actively searching for the answer to the question. At each sitting, read only as much of the chapter (usually a single main section) as you can absorb without tiring. Read actively and critically. Ask questions. Take notes. Make the ideas your own: How does what you've read relate to your own life? Does it support or challenge your assumptions? How convincing is the evidence?

"It pays better to wait and recollect by an effort from within, than to look at the book again."
William James, *Principles of Psychology*, 1890

Having read a section, *retrieve* its main ideas: "Active retrieval promotes meaningful learning," says Karpicke (2012). So *test yourself.* This will not only help you figure out what you know, the testing itself will help you learn and retain the information more effectively. Even better, test yourself repeatedly. To facilitate this, we offer periodic *Retrieval Practice* opportunities throughout each chapter (see, for example, the questions at the end of this section). After answering these questions for yourself, you can check the answers provided, and reread as needed.

Finally, *review:* Read over any notes you have taken, again with an eye on the chapter's organization, and quickly review the whole chapter. Write or say what a concept is before rereading to check your understanding.

Survey, question, read, retrieve, review. We have organized this book's chapters to facilitate your use of the SQ3R study system. Each chapter begins with an outline that aids your *survey.* Headings and Learning Objective *Questions* suggest issues and concepts you should consider as you *read.* The material is organized into sections of readable length. The Retrieval Practice questions will challenge you to *retrieve* what you have learned, and thus better remember it. The end-of-section *Review* is set up as a self-test, with the collected Learning Objective Questions and key terms listed, along with Master the Material questions in a variety of formats. In the e-book, answer-checking is a click away. In the printed text, answers may be found in Appendix C and Appendix D. Survey, question, read . . .

Four additional study tips may further boost your learning:

Distribute your study time. One of psychology's oldest findings is that *spaced practice* promotes better retention than *massed practice.* You'll remember material better if you space your time over several study periods—perhaps one hour a day, six days a week—rather than cram it into one week-long or all-night study blitz. For example, rather than trying to read an entire chapter in a single sitting, read just one main section and then turn to something else. *Interleaving* your study of psychology with your study of other subjects boosts long-term retention and protects against overconfidence (Kornell & Bjork, 2008; Taylor & Rohrer, 2010).

Spacing your study sessions requires a disciplined approach to managing your time. At the beginning of this text, Richard O. Straub explains time management in a helpful preface.

Learn to think critically. Whether you are reading or in class, note people's assumptions and values. What perspective or bias underlies an argument? Evaluate evidence. Is it anecdotal? Or is it based on informative experiments? Assess conclusions. Are there alternative explanations?

[2] Also sometimes called "Recite."

Process class information actively. Listen for the main ideas and sub-ideas of a lecture. *Write them down.* Ask questions during and after class. In class, as in your private study, process the information actively and you will understand and retain it better. As psychologist William James urged a century ago, "*No reception without reaction, no impression without . . . expression.*" Make the information your own. Relate what you read to what you already know. Tell someone else about it. (As any teacher will confirm, to teach is to remember.)

Also, take notes *by hand.* Handwritten notes, in your own words, typically engage more active processing, with better retention, than does verbatim note-taking on laptops (Mueller & Oppenheimer, 2014).

Overlearn. Psychology tells us that overlearning improves retention. We are prone to overestimating how much we know. You may understand a chapter as you read it, but that feeling of familiarity can be deceptively comforting. By using the Retrieval Practice questions as well as our online learning opportunities, you can test your knowledge and *overlearn* in the process.

Memory experts Elizabeth Bjork and Robert Bjork (2011) offer the bottom line for how to improve your retention and your grades:

> Spend less time on the input side and more time on the output side, such as summarizing what you have read from memory or getting together with friends and asking each other questions. Any activities that involve testing yourself—that is, activities that require you to retrieve or generate information, rather than just representing information to yourself—will make your learning both more durable and flexible. (p. 63)

More learning tips To learn more about the testing effect and the SQ3R method, view the 5-minute animation, "Make Things Memorable," at tinyurl.com/HowToRemember.

RETRIEVAL PRACTICE

RP-12 The _____ _____ describes the enhanced memory that results from repeated retrieval (as in self-testing) rather than from simple rereading of new information.

RP-13 What does the acronym SQ3R stand for?

REVIEW What Is Psychology?

LEARNING OBJECTIVES

Test yourself by taking a moment to answer each of these Learning Objective Questions (repeated here from within this Prologue). Then check your answer—a click away in the e-book, and in Appendix C of the printed text. Research suggests that trying to answer these questions on your own will improve your long-term retention (McDaniel et al., 2009, 2015).

LOQ P-1 How is psychology a science, and why is it the "rat is always right"?

LOQ P-2 What are the three key elements of the scientific attitude, and how do they support scientific inquiry?

LOQ P-3 How does critical thinking feed a scientific attitude, and smarter thinking for everyday life?

LOQ P-4 What were some important milestones in psychology's early development?

LOQ P-5 How did behaviorism, Freudian psychology, and humanistic psychology further the development of psychological science?

LOQ P-6 How has contemporary psychology focused on cognition, on biology and experience, on culture and gender, and on human flourishing?

LOQ P-7 What are psychology's levels of analysis and related perspectives?

LOQ P-8 What are psychology's main subfields?

LOQ P-9 How can psychological principles help you learn, remember, and thrive?

RETRIEVAL PRACTICE ANSWERS

RP-12 testing effect. **RP-13** Survey, Question, Read, Retrieve, Review

TERMS AND CONCEPTS TO REMEMBER

Test yourself on these terms by trying to compose the definition before checking your answers.

empirical approach, p. 3
critical thinking, p. 3
structuralism, p. 7
functionalism, p. 7
behaviorism, p. 9
humanistic psychology, p. 9
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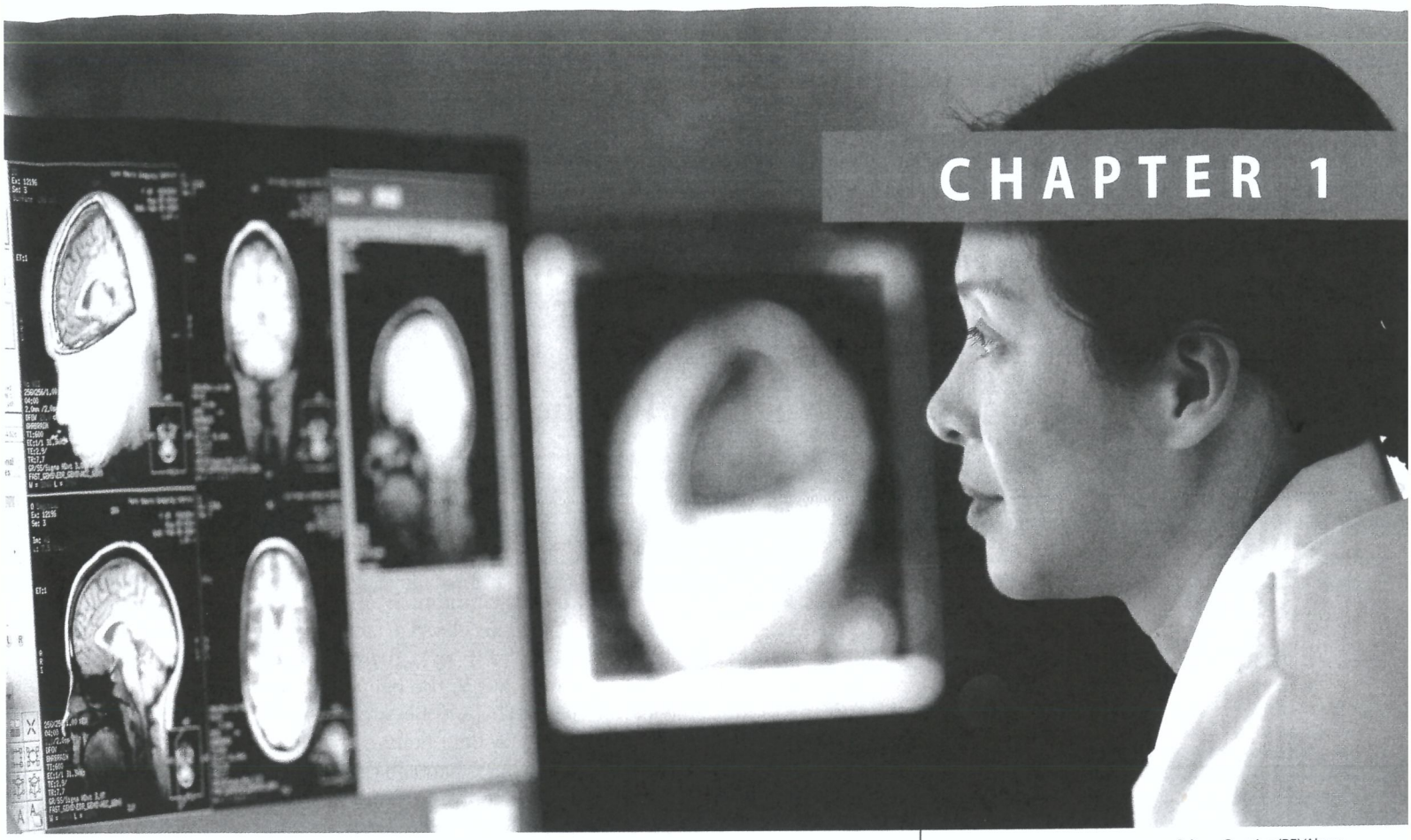
MASTER THE MATERIAL

Test yourself repeatedly throughout your studies. This will not only help you figure out what you know and don't know; the testing itself will help you learn and remember the information more effectively thanks to the *testing effect*.

1. How can critical thinking help you evaluate claims in the media, even if you're not a scientific expert on the issue?
2. In 1879, in psychology's first experiment, _____ and his students measured the time lag between hearing a ball hit a platform and pressing a key.
3. William James would be considered a(n) _____. Wilhelm Wundt and Edward Titchener would be considered _____.
   a. functionalist; structuralists
   b. structuralist; functionalists
   c. evolutionary theorist; structuralists
   d. functionalist; evolutionary theorists
4. In the early twentieth century, _____ redefined psychology as "the science of observable behavior."
   a. John B. Watson
   b. Abraham Maslow
   c. William James
   d. Sigmund Freud
5. Nature is to nurture as
   a. personality is to intelligence.
   b. biology is to experience.
   c. intelligence is to biology.
   d. psychological traits are to behaviors.
6. "Nurture works on what nature provides." Describe what this means, using your own words.
7. Which of the following is true regarding gender differences and similarities?
   a. Differences between the genders outweigh any similarities.
   b. Despite some gender differences, the underlying processes of human behavior are the same.
   c. Both similarities and differences between the genders depend more on biology than on environment.
   d. Gender differences are so numerous that it is difficult to make meaningful comparisons.
8. Martin Seligman and other researchers who explore various aspects of human flourishing refer to their field of study as _____ _____.
9. A psychologist treating emotionally troubled adolescents at a local mental health agency is most likely to be a(n)
   a. research psychologist.
   b. psychiatrist.
   c. industrial-organizational psychologist.
   d. clinical psychologist.
10. A mental health professional with a medical degree who can prescribe medication is a _____.
11. A psychologist conducting basic research to expand psychology's knowledge base may
    a. design a computer screen with limited glare and assess the effect on computer operators' eyes after a day's work.
    b. treat older people who are overcome by depression.
    c. observe 3- and 6-year-olds solving puzzles and analyze differences in their abilities.
    d. interview children with behavioral problems and suggest treatments.

Answers are a click away in the e-book, and available in Appendix D at the back of the printed text.

Use **LearningCurve** to create your personalized study plan, which will direct you to the Macmillan resources that will help you most.



Cultura Creative (RF)/Alamy

Thinking Critically With Psychological Science

Hoping to satisfy their curiosity about people and to relieve their own woes, millions turn to "psychology." They watch television shows aimed at helping people cope with their problems, overcome their addictions, and save their marriages. They read articles on supposed psychic powers. They attend stop-smoking hypnosis seminars. They play online games hoping to strengthen their brain. They immerse themselves in self-help websites and books on the meaning of dreams, the path to ecstatic love, and the road to personal happiness.

Others, intrigued by claims of psychological truth, wonder: How—and how much—does parenting shape children's personalities and abilities? Are first-born children more driven to achieve? Do dreams have deep meaning? Do we sometimes remember events that never happened? Does psychotherapy heal?

In working with such questions, how can we separate uninformed opinions from examined conclusions? Let's consider how psychology's researchers put the scientific method into action to learn more about this fascinating field.

hindsight bias the tendency to believe, after learning an outcome, that one would have foreseen it. (Also known as the *I-knew-it-all-along phenomenon.*)

Research Strategies: How Psychologists Ask and Answer Questions

The Need for Psychological Science

LOQ LEARNING OBJECTIVE QUESTION 1-1 How does our everyday thinking sometimes lead us to a wrong conclusion?

Some people suppose that psychology is mere common sense—documenting and dressing in jargon what people already know: "You get paid for using fancy methods to prove what my grandmother knows?" Indeed, Grandma is often right. As the baseball great Yogi Berra (1925–2015) once said, "You can observe a lot by watching." (We have Berra to thank for other gems, such as "Nobody goes there any more—it's too crowded," and "If the people don't want to come out to the ballpark, nobody's gonna stop 'em.") Because we're all behavior watchers, it would be surprising if many of psychology's findings had *not* been foreseen. Many people believe that love breeds happiness, for example, and they are right (we have what Chapter 11 calls a deep "need to belong").

But sometimes Grandma's common sense, informed by countless casual observations, is wrong. In later chapters, we will see how research has overturned popular ideas—that familiarity breeds contempt, that dreams predict the future, and that most of us use only 10 percent of our brain. We will also see how research has surprised us with discoveries about how the brain's chemical messengers control our moods and memories, about other animals' abilities, and about the effects of stress on our capacity to fight disease.

Other things seem like commonsense truth only because we so often hear them repeated. Mere repetition of statements—whether true or false—makes them easier to process and remember, and thus more true-seeming (Dechêne et al., 2010; Fazio et al., 2015). Easy to remember misconceptions ("Vitamin C prevents the common cold") can therefore overwhelm hard truths. This power of familiar, hard-to-erase falsehoods is a lesson well known to political manipulators, and kept in mind by critical thinkers.

Three roadblocks to critical thinking—*hindsight bias*, *overconfidence*, and *perceiving patterns in random events*—help illustrate why we cannot rely solely on common sense.

"Those who trust in their own wits are fools."
Proverbs 28:26

Did We Know It All Along? Hindsight Bias

Consider how easy it is to draw the bull's eye *after* the arrow strikes. After the stock market drops, people say it was "due for a correction." After the athletic match, we credit the coach if a "gutsy play" wins the game, and fault the coach for the same "stupid play" if it doesn't. After a war or an election, its outcome usually seems obvious. Although history may therefore seem like a series of inevitable events, the actual future is seldom foreseen. No one's diary recorded, "Today the Hundred Years War began."

"Life is lived forwards, but understood backwards."
Philosopher Søren Kierkegaard, 1813–1855

This **hindsight bias** (also known as the *I-knew-it-all-along phenomenon*) is easy to demonstrate by giving half the members of a group some purported psychological finding, and giving the other half an opposite result. Tell the first group, for example: "Psychologists have found that separation weakens romantic attraction. As the saying goes, 'Out of sight, out of mind.'" Ask them to imagine why this might be true. Most people can, and after explaining it nearly all will then view this true finding as unsurprising.

"Anything seems commonplace, once explained."
Dr. Watson to Sherlock Holmes

Tell the second group the opposite: "Psychologists have found that separation strengthens romantic attraction. As the saying goes, 'Absence makes the heart grow fonder.'" People given this untrue result can also easily imagine it, and most will also see it as unsurprising. When opposite findings both seem like common sense, there is a problem.

Such errors in people's recollections and explanations show why we need psychological research. It's not that common sense is usually wrong. Rather, common sense describes, after the fact, what *has* happened better than it predicts what *will* happen.

More than 800 scholarly papers have shown hindsight bias in people young and old from across the world (Roese & Vohs, 2012). As physicist Niels Bohr reportedly jested, "Prediction is very difficult, especially about the future."

Overconfidence

We humans tend to think we know more than we do. Asked how sure we are of our answers to factual questions *(Is Boston north or south of Paris?)*, we tend to be more confident than correct.[1] Or consider these three anagram solutions (from Goranson, 1978):

WREAT — > WATER

ETRYN — > ENTRY

GRABE — > BARGE

About how many seconds do you think it would have taken you to unscramble each of these? Did hindsight influence you? Knowing the answers tends to make us overconfident. (Surely the solution would take only 10 seconds or so?) In reality, the average problem solver spends 3 minutes, as you also might, given a similar anagram without the solution: OCHSA.[2]

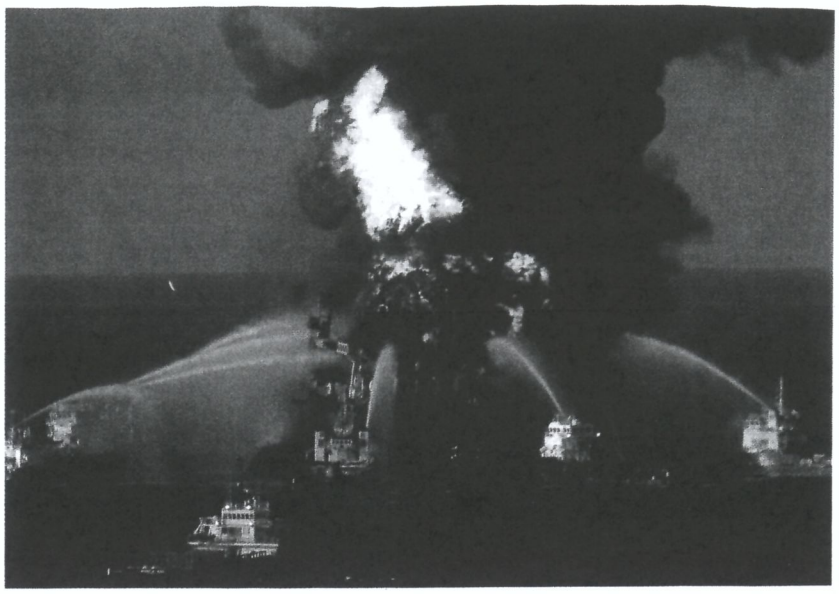
Are we any better at predicting social behavior? Psychologist Philip Tetlock (1998, 2005) collected more than 27,000 expert predictions of world events, such as the future of South Africa or whether Quebec would separate from Canada. His repeated finding: These predictions, which experts made with 80 percent confidence on average, were right less than 40 percent of the time. Nevertheless, even those who erred maintained their confidence by noting they were "almost right." "The Québécois separatists *almost* won the secessionist referendum."

RETRIEVAL PRACTICE

RP-1 Why, after friends start dating, do we often feel that we *knew* they were meant to be together?

Perceiving Order in Random Events

For most people, a random, unpredictable world is unsettling (Tullett et al., 2015). We therefore have a built-in eagerness to make sense of our world. People may see a face on the Moon, hear satanic messages in music, perceive the Virgin Mary's image on a grilled cheese sandwich. Even in random data, we often find patterns, because—here's a curious fact of life—*random sequences often don't look random* (Falk et al., 2009; Nickerson, 2002, 2005). Flip a coin 50 times and you will likely be surprised at the streaks of heads or tails—much like supposed "hot" and "cold" streaks in basketball shooting and baseball hitting. In actual random sequences, patterns and streaks (such as repeating digits) occur more often than people expect (Oskarsson et al., 2009). That also makes it hard for people to generate random-like sequences. When embezzlers try to simulate random digits, their nonrandom patterns can alert fraud experts (Poundstone, 2014).



U.S. Coast Guard/Handout/Everett Collection/Newscom

Hindsight bias When drilling its Deepwater Horizon oil well in 2010, BP employees took shortcuts and ignored warning signs, without intending to harm any people, the environment, or their company's reputation. *After* the resulting Gulf oil spill, with the benefit of hindsight, the foolishness of those judgments became obvious.

Fun anagram solutions from Wordsmith (wordsmith.org):
Snooze alarms = Alas! No more z's
Dormitory = dirty room
Slot machines = cash lost in 'em

Overconfidence in history:
"We don't like their sound. Groups of guitars are on their way out."
Decca Records, in turning down a recording contract with the Beatles in 1962

"Computers in the future may weigh no more than 1.5 tons."
Popular Mechanics, 1949

"They couldn't hit an elephant at this distance."
General John Sedgwick just before being killed during a U.S. Civil War battle, 1864

"The telephone may be appropriate for our American cousins, but not here, because we have an adequate supply of messenger boys."
British expert group evaluating the invention of the telephone

RETRIEVAL PRACTICE ANSWER

RP-1 We often suffer from hindsight bias—after we've learned a situation's outcome, that outcome seems familiar and therefore obvious.

OTHER FOOTNOTES

[1] Boston is south of Paris.

[2] The anagram solution: CHAOS.

Bizarre-looking, perhaps. But actually no more unlikely than any other number sequence.

Some happenings, such as winning a lottery twice, seem so extraordinary that we find it difficult to conceive an ordinary, chance-related explanation. "But with a large enough sample, any outrageous thing is likely to happen," note statisticians Persi Diaconis and Frederick Mosteller (1989). An event that happens to but 1 in 1 billion people every day occurs about 7 times a day, more than 2500 times a year.

The point to remember: Hindsight bias, overconfidence, and our tendency to perceive patterns in random events tempt us to overestimate our intuition. But scientific inquiry can help us sift reality from illusion.

"The really unusual day would be one where nothing unusual happens."
Statistician Persi Diaconis (2002)

Our online learning tools will help you excel in this course. Take advantage of self-tests, interactive simulations, "Assess Your Strengths" personal self-assessments, and Immersive Learning "How Would You Know?" activities. See LaunchPadWorks.com for more information.

Consider how scientific inquiry can help you think smarter about random hot streaks in sports by engaging online with **Immersive Learning: How Would You Know If There Is a "Hot Hand" in Basketball?**

The Scientific Method

At the foundation of all science is a scientific attitude that combines *curiosity*, *skepticism*, and *humility*. Psychologists arm their scientific attitude with the *scientific method*—a self-correcting process for evaluating ideas with observation and analysis. Psychological science welcomes hunches and plausible-sounding theories. And it puts them to the test. If a theory works—if the data support its predictions—so much the better for that theory. If its predictions fail, the theory gets revised or rejected.

Constructing Theories

LOQ 1-2 How do theories advance psychological science?

In everyday conversation, we often use *theory* to mean "mere hunch." Someone might, for example, discount evolution as "only a theory"—as if it were mere speculation. In science, a **theory** explains behaviors or events by offering ideas that organize observations. By using deeper principles to organize isolated facts, a theory summarizes and simplifies. As we connect the observed dots, a coherent picture emerges.

A theory of how sleep affects memory, for example, helps us organize countless sleep-related observations into a short list of principles. Imagine that we observe over and over that people with good sleep habits tend to answer questions correctly in class and do well at test time. We might therefore theorize that sleep improves memory. So far so good: Our principle neatly summarizes a list of observations about the effects of a good night's sleep.

Yet no matter how reasonable a theory may sound—and it does seem reasonable to suggest that sleep boosts memory—we must put it to the test. A good theory produces testable *predictions*, called **hypotheses**. Such predictions specify what results would support the theory and what results would disconfirm it. To test our theory about sleep effects on memory, our hypothesis might be that when sleep deprived, people will remember less from the day before. To test that hypothesis, we might assess how well people remember course materials they studied either before a good night's sleep or before a shortened night's sleep (**FIGURE 1.1**). The results will either support our theory or lead us to revise or reject it.

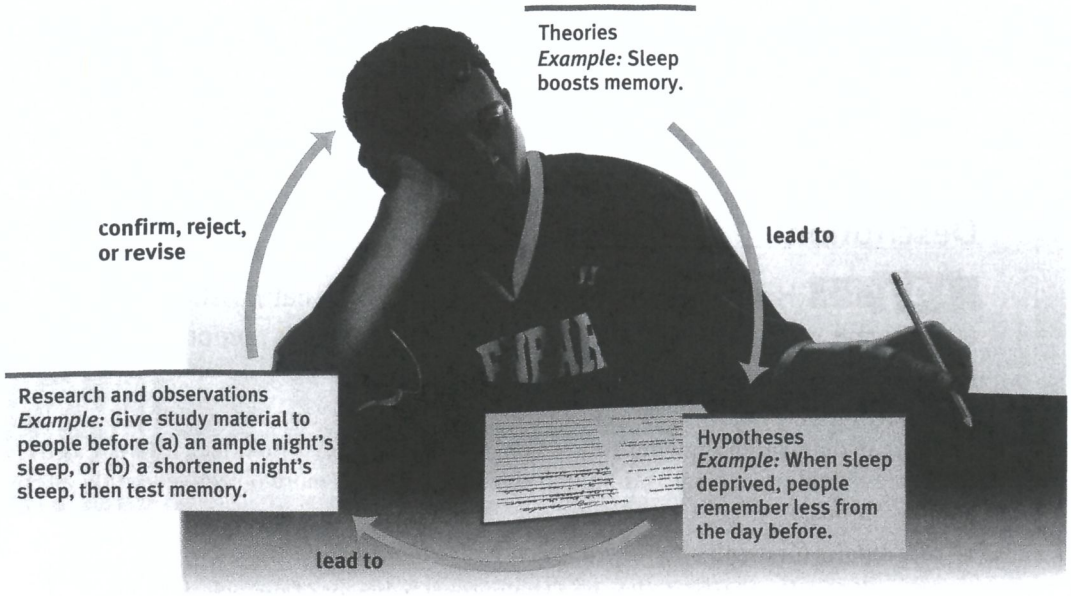
Our theories can bias our observations. Having theorized that better memory springs from more sleep, we may see what we expect: We may perceive sleepy people's comments as less accurate. The urge to see what we expect is ever-present, both inside and outside the laboratory, as when people's views of climate change influence their interpretation of local weather events.

theory an explanation using an integrated set of principles that organizes observations and predicts behaviors or events.

hypothesis a testable prediction, often implied by a theory.

operational definition a carefully worded statement of the exact procedures (operations) used in a research study. For example, *human intelligence* may be operationally defined as what an intelligence test measures.

replication repeating the essence of a research study, usually with different participants in different situations, to see whether the basic finding can be reproduced.



◀ FIGURE 1.1
The scientific method
A self-correcting process for asking questions and observing nature's answers.

As a check on their biases, psychologists report their research with precise **operational definitions** of procedures and concepts. *Sleep deprived*, for example, may be defined as "X hours less" than the person's natural sleep. Using these carefully worded statements, others can **replicate** (repeat) the original observations with different participants, materials, and circumstances. If they get similar results, confidence in the finding's reliability grows. The first study of hindsight bias, for example, aroused psychologists' curiosity. Now, after many successful replications with differing people and questions, we feel sure of the phenomenon's power. Replication is confirmation.

Replication is an essential part of good science. In psychology, recent replication efforts have produced mixed results. One recent cluster of replications brought encouraging news: All but 2 of 13 experiments were successfully replicated (Klein et al., 2014). But then when 270 psychologists together redid 100 psychological studies, the results were disheartening: Only 36 percent of the results were replicated (Open Science Collaboration, 2015). (None of the nonreproducible findings appears in this text.) However, another team of scientists found that most of the failed replications did not accurately re-create the original study. "The reproducibility of psychological science" is actually "quite high," they concluded (Gilbert et al., 2016). Still others argued that certain research topics made replication more difficult (Van Bavel et al., 2016). Despite the differing findings, most researchers agree that science will benefit from more replications and from greater transparency as researchers increasingly disclose their detailed methods and data (Munafò et al., 2017; Open Science Collaboration, 2017).

Other fields, including medicine, also have nonreplicated findings (Collins & Tabak, 2014). Especially when based on a small sample, a single failure to replicate needs replication itself (Maxwell et al., 2015). In all scientific fields, replication either confirms findings, or enables us to revise our understanding.

"Failure to replicate is not a bug; it is a feature. It is what leads us along the path—the wonderfully twisty path—of scientific discovery."
Lisa Feldman Barrett, "Psychology Is Not in Crisis," 2015

In both psychological and medical science, another important tool in psychology's toolkit is *meta-analysis*. A meta-analysis statistically combines the results of many studies to provide a bottom-line result.

In the end, our theory will be useful if it (1) *organizes* observations, and (2) implies *predictions* that anyone can use to check the theory or to derive practical applications. (Does people's sleep predict their retention?) Eventually, our research may (3) stimulate further research that leads to a revised theory that better organizes and predicts.

As we will see next, we can test our hypotheses and refine our theories using *descriptive* methods (which describe behaviors, often through case studies, surveys, or naturalistic observations), *correlational* methods (which associate different factors), and *experimental* methods (which manipulate factors to discover their effects). To think critically about popular psychology claims, we need to understand these methods and know what conclusions they allow.

case study a descriptive technique in which one individual or group is studied in depth in the hope of revealing universal principles.

naturalistic observation a descriptive technique of observing and recording behavior in naturally occurring situations without trying to manipulate and control the situation.

RETRIEVAL PRACTICE

RP-2 What does a good theory do?

RP-3 Why is replication important?

Description

LOQ 1-3 How do psychologists use case studies, naturalistic observations, and surveys to observe and describe behavior, and why is random sampling important?

The starting point of any science is description. In everyday life, we all observe and describe people, often drawing conclusions about why they think, feel, and act as they do. Professional psychologists do much the same, though more objectively and systematically, through

- *case studies* (in-depth analyses of individuals or groups).
- *naturalistic observations* (recording the natural behavior of many individuals).
- *surveys* and interviews (asking people questions).

THE CASE STUDY Among the oldest research methods, the **case study** examines one individual or group in depth in the hope of revealing things true of us all. Some examples:

- *Brain damage.* Much of our early knowledge about the brain came from case studies of individuals who suffered particular impairments after damage to a certain brain region.
- *Children's minds.* Jean Piaget taught us about children's thinking after carefully observing and questioning only a few children.
- *Animal intelligence.* Studies of various animals, including only a few chimpanzees, have revealed their capacity for understanding and language.

"'Well my dear,' said Miss Marple, 'human nature is very much the same everywhere, and of course, one has opportunities of observing it at closer quarters in a village'."
Agatha Christie, *The Tuesday Club Murders,* 1933

Intensive case studies are sometimes very revealing, and they often suggest directions for further study.

See the **Video: Case Studies** for an animated tutorial.

But atypical individual cases may mislead us. Both in our everyday lives and in science, unrepresentative information can lead to mistaken judgments and false conclusions. Indeed, anytime a researcher mentions a finding (*Smokers die younger: 95 percent of men over 85 are nonsmokers*) someone is sure to offer a contradictory anecdote (*Well, I have an uncle who smoked two packs a day and lived to be 89*). Dramatic stories and personal experiences (even psychological case examples) command our attention and are easily remembered. Journalists understand that, and often begin their articles with compelling stories. Stories move us. But stories can mislead. Which of the following do you find more memorable? (1) "In one study of 1300 dream reports concerning a kidnapped child, only 5 percent correctly envisioned the child as dead" (Murray & Wheeler, 1937). (2) "I know a man who dreamed his sister was in a car accident, and two days later she died in a head-on collision!" Numbers can be numbing, *but the plural of anecdote is not evidence.* A single story of someone who supposedly changed from gay to straight is not evidence that sexual orientation is a choice. As psychologist Gordon Allport (1954, p. 9) said, "Given a thimbleful of [dramatic] facts we rush to make generalizations as large as a tub."

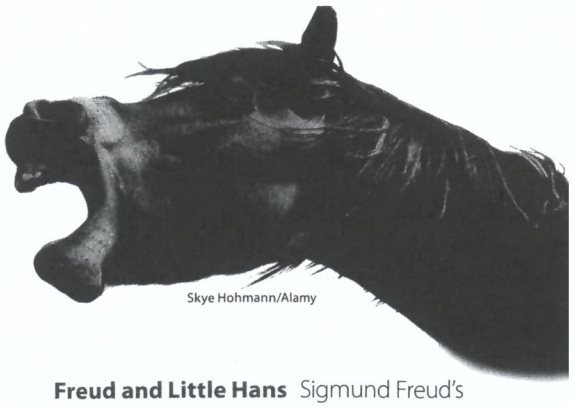
RETRIEVAL PRACTICE ANSWERS

RP-2 1. It *organizes* observed facts. 2. It implies hypotheses that offer testable *predictions* and, sometimes, practical applications. 3. It often stimulates further research. **RP-3** When other investigators are able to replicate an experiment with the same (or stronger) results, scientists can confirm the result and become more confident of its reliability.

The point to remember: Individual cases can suggest fruitful ideas. What's true of all of us can be glimpsed in any one of us. To find those general truths, we must employ other research methods.

RETRIEVAL PRACTICE

RP-4 We cannot assume that case studies always reveal general principles that apply to all of us. Why not?

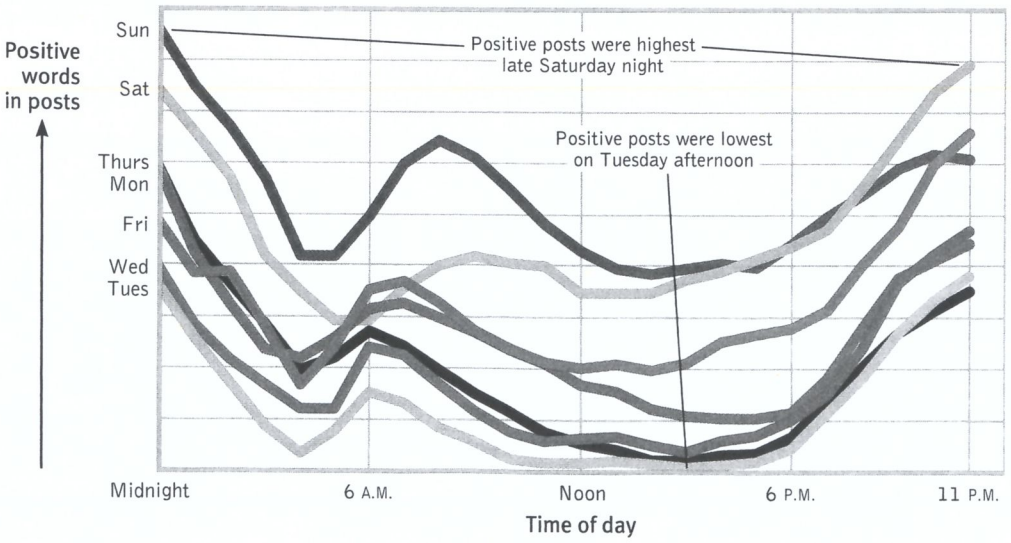


Freud and Little Hans Sigmund Freud's case study of 5-year-old Hans' extreme fear of horses led Freud to his theory of childhood sexuality. He conjectured that Hans felt unconscious desire for his mother, feared castration by his rival father, and then transferred this fear into his phobia about being bitten by a horse. As Chapter 14 will explain, today's psychological science discounts Freud's theory of childhood sexuality but does agree that much of the human mind operates outside our conscious awareness.

NATURALISTIC OBSERVATION A second descriptive method records behavior in natural environments. These **naturalistic observations** range from watching chimpanzee societies in the jungle, to videotaping and analyzing parent-child interactions in different cultures, to recording racial differences in students' self-seating patterns in a school lunchroom.

Naturalistic observation has mostly been "small science"—science that can be done with pen and paper rather than fancy equipment and a big budget (Provine, 2012). But new technologies, such as smart-phone apps, body-worn sensors, and social media, are enabling "big data" observations. Using such tools, researchers can track people's location, activities, and opinions—without interference. The billions of people on Facebook, Twitter, and Google have also created a huge new opportunity for big-data naturalistic observation. One research team studied the ups and downs of human moods by counting positive and negative words in 504 million Twitter messages from 84 countries (Golder & Macy, 2011). As **FIGURE 1.2** shows, people seem happier on weekends, shortly after waking, and in the evenings. (Are late Saturday evenings often a happy time for you, too?) Another study found that the proportion of negative emotion (especially anger-related) words in 148 million tweets from 1347 U.S. counties predicted the counties' heart disease rates. Moreover, it did so even better than other predictors such as smoking and obesity rates (Eichstaedt et al., 2015).

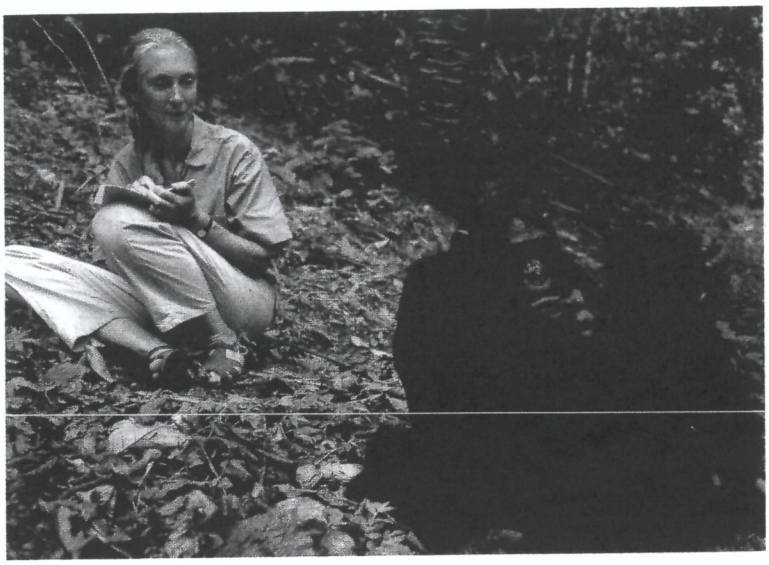
Like the case study, naturalistic observation does not *explain* behavior. It *describes* it. Nevertheless, descriptions can be revealing. We once thought, for example, that only humans use tools. Then naturalistic observation revealed that chimpanzees sometimes insert a stick in a termite mound and withdraw it, eating the stick's load of termites.



◀ FIGURE 1.2
Twitter message moods, by time and by day This illustrates how, without knowing anyone's identity, big data enable researchers to study human behavior on a massive scale. It now is also possible to associate people's moods with, for example, their locations or with the weather, and to study the spread of ideas through social networks. (Data from Golder & Macy, 2011.)

RETRIEVAL PRACTICE ANSWER

RP-4 Case studies involve only one individual or group, so we can't know for sure whether the principles observed would apply to a larger population.



MICHAEL NICHOLS/National Geographic Creative

A natural observer "Observations, made in the natural habitat, helped to show that the societies and behavior of animals are far more complex than previously supposed," chimpanzee observer Jane Goodall noted (1998).

Such unobtrusive naturalistic observations paved the way for later studies of animal thinking, language, and emotion, which further expanded our understanding of our fellow animals. Thanks to researchers' observations, we know that chimpanzees and baboons use deception: Psychologists repeatedly saw one young baboon pretending to have been attacked by another as a tactic to get its mother to drive the other baboon away from its food (Whiten & Byrne, 1988).

Naturalistic observations also illuminate human behavior. Here are three findings you might enjoy:

- A *funny finding.* We humans laugh 30 times more often in social situations than in solitary situations (Provine, 2001). (Have you noticed how seldom you laugh when alone?)
- *Sounding out students.* What, really, are introductory psychology students saying and doing during their everyday lives? To find out, Matthias Mehl and his colleagues (2010) equipped 79 such students with electronic recorders. Using this *experience sampling method,* the researchers then eavesdropped on more than 23,000 half-minute life slices of students' waking hours. Was happiness related to having simple talks or deeply involved conversations? The happiest participants avoided small talk and embraced meaningful conversations. Happy people would also rather talk than tweet. Does that surprise you?
- *Culture and the pace of life.* Naturalistic observation also enabled Robert Levine and Ara Norenzayan (1999) to compare the pace of life—walking speed, accuracy of public clocks, and so forth—in 31 countries. Their conclusion: Life is fastest paced in Japan and Western Europe, and slower paced in economically less-developed countries.

Naturalistic observation offers interesting snapshots of everyday life, but it does so without controlling for all the factors that may influence behavior. It's one thing to observe the pace of life in various places, but another to understand what makes some people walk faster than others. Nevertheless, descriptions can be revealing: The starting point of any science is description.

See the **Video: Naturalistic Observation** for a helpful tutorial animation.

THE SURVEY A **survey** looks at many cases in less depth, asking people to report their behavior or opinions. Questions about everything from sexual practices to political opinions are put to the public. In recent surveys:

- Compared with those born in the 1960s and 1970s, twice as many Millennials born in the 1990s reported having no sexual partners since age 18 (Twenge et al., 2016b).
- 1 in 5 people across 22 countries report believing that alien beings have come to Earth and now walk among us disguised as humans (Ipsos, 2010).

RETRIEVAL PRACTICE

Courtesy of Matthias Mehl

An EAR for naturalistic observation Psychologists Matthias Mehl and James Pennebaker have used electronically activated recorders (EARs) to sample naturally occurring slices of daily life.

RP-5 What are the advantages and disadvantages of naturalistic observation, such as Mehl and his colleagues used in this study?

RETRIEVAL PRACTICE ANSWER

RP-5 These researchers were able to carefully observe and record naturally occurring behaviors outside the artificiality of a laboratory. However, outside the lab they were not able to control for all the factors that may have influenced the everyday interactions they were recording.

- 68 percent of all humans—some 5 billion people—say that religion is important in their daily lives (Diener et al., 2011).

But asking questions is tricky, and the answers often depend on how questions are worded and how respondents are chosen.

Wording Effects Even subtle changes in the order or wording of questions can have major effects. People are more approving of "aid to the needy" than of "welfare," of "affirmative action" than of "preferential treatment," of "not allowing" televised pornography than of "censoring" it, of "gun safety" laws than of "gun control" laws, and of "revenue enhancers" than of "taxes." Because wording is such a delicate matter, critical thinkers will reflect on how the phrasing of a question might affect people's expressed opinions.

Random Sampling In everyday thinking, we tend to generalize from samples we observe, especially vivid cases. An administrator who reads (a) a statistical summary of a professor's student evaluations and (b) the vivid comments of two irate students may be influenced as much by the biased sample of two unhappy students as by the many favorable evaluations in the statistical summary. The temptation to succumb to the *sampling bias*—to generalize from a few vivid but unrepresentative cases—is nearly irresistible.

So how do you obtain a *representative sample?* Say you want to learn how students at your college or university feel about a proposed tuition increase. It's often not possible to survey the whole group. How then could you choose a group that would represent the total student body? Typically, you would seek a **random sample**, in which every person in the entire **population** has an equal chance of being in the sample group. You might number the names in the general student listing and then use a random number generator to pick your survey participants. (Sending each student a questionnaire wouldn't work because the conscientious people who returned it would not be a random sample.) Large representative samples are better than small ones, but a smaller representative sample of 100 is better than a larger unrepresentative sample of 500.

Political pollsters sample voters in national election surveys just this way. Using some 1500 randomly sampled people, drawn from all areas of a country, they can provide a remarkably accurate snapshot of the nation's opinions. Without random sampling, large samples—including unrepresentative call-in phone samples and TV or website polls—often give misleading results.

The point to remember: Before accepting survey findings, think critically. Consider the sample. The best basis for generalizing is from a representative sample. You cannot compensate for an unrepresentative sample by simply adding more people.

survey a descriptive technique for obtaining the self-reported attitudes or behaviors of a particular group, usually by questioning a representative, *random sample* of the group.

random sample a sample that fairly represents a population because each member has an equal chance of inclusion.

population all those in a group being studied, from which samples may be drawn. (*Note:* Except for national studies, this does not refer to a country's whole population.)

correlation a measure of the extent to which two factors vary together, and thus of how well either factor predicts the other.

correlation coefficient a statistical index of the relationship between two things (from −1.00 to +1.00).

With very large samples, estimates become quite reliable. *E* is estimated to represent 12.7 percent of the letters in written English. *E*, in fact, is 12.3 percent of the 925,141 letters in Melville's *Moby-Dick*, 12.4 percent of the 586,747 letters in Dickens' *A Tale of Two Cities*, and 12.1 percent of the 3,901,021 letters in 12 of Mark Twain's works (*Chance News*, 1997).

RETRIEVAL PRACTICE

RP-6 What is an unrepresentative sample, and how do researchers avoid it?

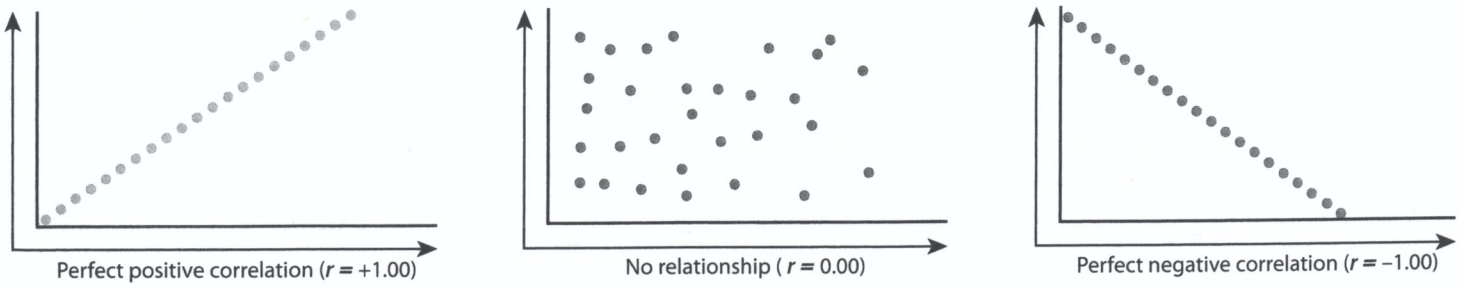
Correlation

LOQ 1-4 What does it mean when we say two things are correlated, and what are positive and negative correlations?

Describing behavior is a first step toward predicting it. Naturalistic observations and surveys often show us that one trait or behavior tends to coincide with another. In such cases, we say the two **correlate**. A statistical measure (the **correlation coefficient**) helps us figure how closely two things vary together, and thus how well either one *predicts* the other. Knowing how much aptitude test scores *correlate* with school success tells us how well the scores *predict* school success.

RETRIEVAL PRACTICE ANSWER

RP-6 An unrepresentative sample is a group that does not represent the entire population being studied. *Random sampling* helps researchers form a representative sample, because each member of the population has an equal chance of being included.



▲ FIGURE 1.3
Scatterplots, showing patterns of correlation Correlations—abbreviated *r*—can range from +1.00 (scores for one variable increase in direct proportion to scores for another), to 0.00 (no relationship), to –1.00 (scores for one variable decrease precisely as scores rise for the other).

Throughout this book, we will often ask how strongly two **variables** are related: For example, how closely related are the personality scores of identical twins? How well do intelligence test scores predict career achievement? How closely is stress related to disease? In such cases, **scatterplots** can be very revealing.

Each dot in a scatterplot represents the values of two variables. The three scatterplots in **FIGURE 1.3** illustrate the range of possible correlations from a perfect positive to a perfect negative. (Perfect correlations rarely occur in the real world.) A correlation is positive if two sets of scores, such as for height and weight, tend to rise or fall together.

Saying that a correlation is "negative" says nothing about its strength. A correlation is negative if two sets of scores relate inversely, one set going up as the other goes down. The correlation between people's height and the distance from their head to the ceiling is strongly (perfectly, in fact) negative.

Statistics can help us see what the naked eye sometimes misses. To demonstrate this for yourself, try an imaginary project. You wonder if tall men are more or less easygoing, so you collect two sets of scores: men's heights and men's temperaments. You measure the heights of 20 men, and you have someone else independently assess their temperaments from 0 *(extremely calm)* to 100 *(highly reactive)*.

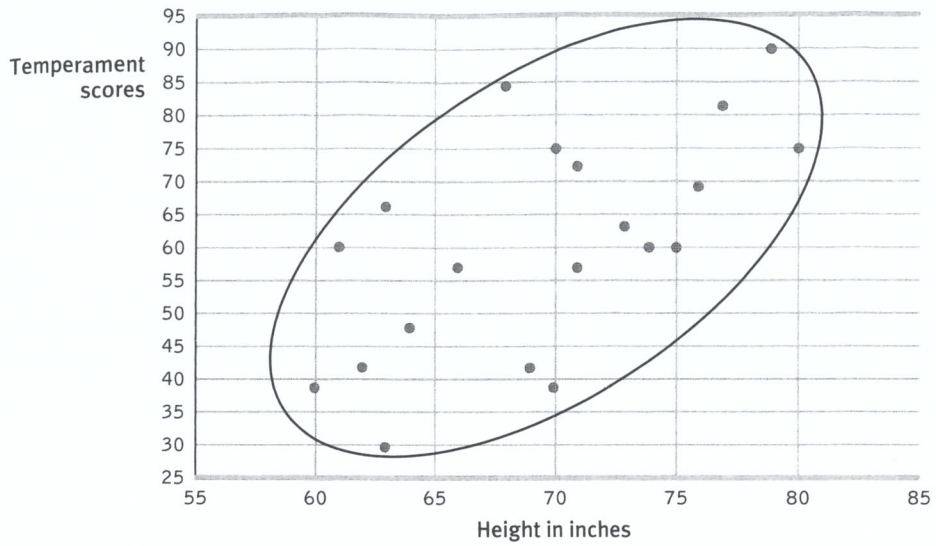
With all the relevant data right in front of you (**TABLE 1.1**), can you tell whether the correlation between height and reactive temperament is positive, negative, or close to zero?

Comparing the columns in Table 1.1, most people detect very little relationship between height and temperament. In fact, the correlation in this imaginary example is positive ($r = +0.63$), as we can see if we display the data as a scatterplot (**FIGURE 1.4**).

If we fail to see a relationship when data are presented as systematically as in Table 1.1, how much less likely are we to notice them in everyday life? To see what is right in front of us, we sometimes need statistical illumination. We can easily see evidence of gender discrimination when given statistically summarized information about job level,

TABLE 1.1
Height and Temperamental Reactivity of 20 Men

Person	Height in Inches	Temperament	Person	Height in Inches	Temperament
1	80	75	*11*	64	48
2	63	66	*12*	76	69
3	61	60	*13*	71	72
4	79	90	*14*	66	57
5	74	60	*15*	73	63
6	69	42	*16*	70	75
7	62	42	*17*	63	30
8	75	60	*18*	71	57
9	77	81	*19*	68	84
10	60	39	*20*	70	39



◀ FIGURE 1.4
Scatterplot for height and temperamental reactivity This display of data from 20 imagined people (each represented by a data point) reveals an upward slope, indicating a positive correlation. The considerable scatter of the data indicates the correlation is much lower than +1.00.

seniority, performance, gender, and salary. But we often see no discrimination when the same information dribbles in, case by case (Twiss et al., 1989).

The point to remember: A correlation coefficient helps us see the world more clearly by revealing the extent to which two things relate.

RETRIEVAL PRACTICE

RP-7 Indicate whether each association is a positive correlation or a negative correlation.

1. The more husbands viewed Internet pornography, the worse their marital relationships (Muusses et al., 2015). _____
2. The less sexual content teens saw on TV, the less likely they were to have sex (Collins et al., 2004). _____
3. The longer children were breast-fed, the greater their later academic achievement (Horwood & Fergusson, 1998). _____
4. The more income rose among a sample of poor families, the fewer psychiatric symptoms their children experienced (Costello et al., 2003). _____

For an animated tutorial on correlations, visit **Concept Practice: Positive and Negative Correlations**. See also the **Video: Correlational Studies** for another helpful tutorial animation.

ILLUSORY CORRELATION AND REGRESSION TOWARD THE MEAN

LOQ 1-5 What are illusory correlations, and what is regression toward the mean?

Correlations not only make visible the relationships we might otherwise miss, they also restrain our "seeing" nonexistent relationships. When we believe there is a relationship between two things, we are likely to notice and recall instances that confirm our belief. If we believe that dreams forecast actual events, we may notice and recall confirming instances more than disconfirming instances. The result is an **illusory correlation**.

Illusory correlations can feed an illusion of control—that chance events are subject to our personal control. Gamblers, remembering their lucky rolls, may come to

variable anything that can vary and is feasible and ethical to measure.

scatterplot a graphed cluster of dots, each of which represents the values of two variables. The slope of the points suggests the direction of the relationship between the two variables. The amount of scatter suggests the strength of the correlation (little scatter indicates high correlation).

illusory correlation perceiving a relationship where none exists, or perceiving a stronger-than-actual relationship.

RETRIEVAL PRACTICE ANSWER

RP-7 1. negative, 2. positive, 3. positive, 4. negative

regression toward the mean the tendency for extreme or unusual scores or events to fall back (regress) toward the average.

believe they can influence the roll of the dice by again throwing gently for low numbers and hard for high numbers. The illusion that uncontrollable events correlate with our actions is also fed by a statistical phenomenon called **regression toward the mean**. Average results are more typical than extreme results. Thus, after an unusual event, things tend to return toward their average level; extraordinary happenings tend to be followed by more ordinary ones.

The point may seem obvious, yet we regularly miss it: We sometimes attribute what may be a normal regression (the expected return to normal) to something we have done. Consider two examples:

- Students who score much lower or higher on an exam than they usually do are likely, when retested, to return to their average.
- Unusual ESP subjects who defy chance when first tested nearly always lose their "psychic powers" when retested.

Failure to recognize regression is the source of many superstitions and of some ineffective practices as well. After berating an employee for poorer-than-usual performance a manager may—when the employee regresses to normal—feel rewarded for the "tough love." After lavishing praise for an exceptionally fine performance, the manager may be disappointed when the employee's behavior again migrates back toward his or her average. Ironically, then, regression toward the average can mislead us into feeling rewarded after criticizing others and feeling punished after praising them (Tversky & Kahneman, 1974).

"Once you become sensitized to it, you see regression everywhere."
Psychologist Daniel Kahneman (1985)

The point to remember: When a fluctuating behavior returns to normal, there is no need to invent fancy explanations for why it does so. Regression toward the mean is probably at work.

RETRIEVAL PRACTICE

RP-8 You hear the school basketball coach telling her friend that she rescued her team's winning streak by yelling at the players after an unusually bad first half. What is another explanation of why the team's performance improved?

RETRIEVAL PRACTICE

© Nancy Brown/The Image Bank/Getty Images

Correlation need not mean causation.

RP-9 Length of marriage positively correlates with hair loss in men. Does this mean that marriage causes men to lose their hair (or that balding men make better husbands)?

So, although correlational research helpfully reveals relationships, it doesn't explain them. See Thinking Critically About: Correlation and Causation.

Experimentation

LOQ 1-7 What are the characteristics of experimentation that make it possible to isolate cause and effect?

Happy are they, remarked the Roman poet Virgil, "who have been able to perceive the causes of things." How might psychologists sleuth out the causes in correlational studies, such as the correlation between breast feeding and intelligence?

EXPERIMENTAL MANIPULATION Some researchers (not all) have found that breast-fed infants develop higher childhood intelligence scores than do bottle-fed infants—an average 3 IQ point difference in a review of 17 studies (Horta et al., 2015; von Stumm & Plomin, 2015; Walfisch et al., 2014). Moreover, the longer infants breast feed, the higher their later IQ scores (Jedrychowski et al., 2012; Victora et al., 2015).

RETRIEVAL PRACTICE ANSWERS

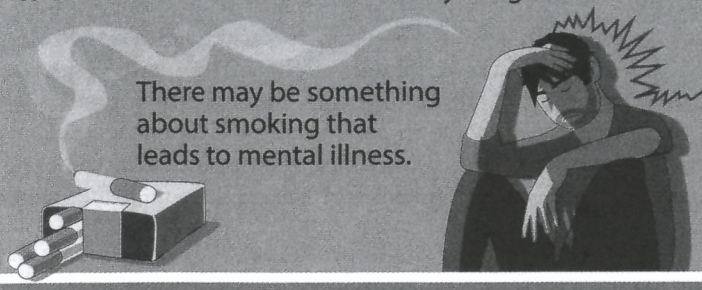
RP-8 The team's poor performance was not their typical behavior. The return to their normal—their winning streak—may just have been a case of regression toward the mean. **RP-9** In this case, as in many others, a third factor can explain the correlation: Golden anniversaries and baldness both accompany aging.

Thinking Critically About:

Correlation and Causation

LOQ 1-6 Why do correlations enable prediction but not cause-effect explanation?

Mental illness *correlates* with smoking—meaning that those who experience mental illness are also more likely to be smokers.[1] Does this tell us anything about what *causes* mental illness or smoking? **NO.**



There may be something about smoking that leads to mental illness.

Those with mental illness may be more likely to smoke.

OR

There may be some *third variable*, such as a stressful home life, for example, that triggers *both* smoking and mental illness.

So, then, how would you interpret these recent findings:

a) sexual hook-ups correlate with college women's experiencing depression, and

b) *delaying* sexual intimacy correlates with positive outcomes such as greater relationship satisfaction and stability?[2]

Possible explanations:

1. Sexual restraint →	Better mental health and stronger relationships
2. Depression →	People being more likely to hook up
3. Some third factor, such as lower impulsivity →	Sexual restraint, psychological well-being, and better relationships

Correlations do help us predict. Consider: Self-esteem correlates negatively with (and therefore predicts) depression. The lower people's self-esteem, the greater their risk for depression.

Possible interpretations:

1. Low self-esteem →	Depression
2. Depression →	Low self-esteem
3. Some third factor, such as distressing events or biological predisposition →	Both low self-esteem and depression

You try it!

A survey of over 12,000 adolescents found that the more teens feel loved by their parents, the less likely they are to behave in unhealthy ways—having early sex, smoking, abusing alcohol and drugs, exhibiting violence.[3] What are three possible ways we could interpret that finding?[4]

***The point to remember:* Correlation does not prove causation.**

Correlation suggests a possible cause-effect relationship but does not prove it. Remember this principle and you will be wiser as you read and hear news of scientific studies.

1. Belluck, 2013. 2. Fielder et al., 2013; Willoughby et al., 2014. 3. Resnick et al., 1997. 4. *ANSWERS:* A. Parental love may produce healthy teens. B. Well-behaved teens may feel more parental love and approval. C. Some third factor, such as income or neighborhood, may influence both parental love AND teen behaviors.

Lane Oatey/blue jean images/Getty Images

Recall that in a well-done survey, *random sampling* is important. In an experiment, *random assignment* is equally important.

What do such findings mean? Do the nutrients of mother's milk contribute to brain development? Or do smarter mothers have smarter children? (Breast-fed children tend to be healthier and higher achieving than other children. But their bottle-fed siblings, born and raised in the same families, tend to be similarly healthy and high achieving [Colen & Ramey, 2014].) Even big data from a million or a billion mothers and their offspring couldn't tell us. To find answers to such questions—to isolate cause and effect—researchers must **experiment**. Experiments enable researchers to isolate the effects of one or more factors by (1) *manipulating the factors of interest* and (2) *holding constant ("controlling") other factors.* To do so, they often create an **experimental group**, in which people receive the treatment, and a contrasting **control group** that does not receive the treatment. To minimize any preexisting differences between the two groups, researchers **randomly assign** people to the two conditions. Random assignment—whether with a random numbers table or flip of the coin—effectively equalizes the two groups. If one-third of the volunteers for an experiment can wiggle their ears, then about one-third of the people in each group will be ear wigglers. So, too, with age, attitudes, and other characteristics, which will be similar in the experimental and control groups. Thus, if the groups differ at the experiment's end, we can surmise that the treatment had an effect.

See the **Video: Random Assignment** for a tutorial animation.

To experiment with breast feeding, one research team randomly assigned some 17,000 Belarus newborns and their mothers either to a control group given normal pediatric care or to an experimental group that promoted breast feeding, thus increasing expectant mothers' breast intentions (Kramer et al., 2008). At three months of age, 43 percent of the infants in the experimental group were being exclusively breast-fed, as were 6 percent in the control group. At age 6, when nearly 14,000 of the children were restudied, those who had been in the breast-feeding promotion group had intelligence test scores averaging six points higher than their control condition counterparts.

With parental permission, one British research team directly experimented with breast milk. They randomly assigned 424 hospitalized premature infants either to formula feedings or to breast-milk feedings (Lucas et al., 1992). Their finding: On intelligence tests taken at age 8, those nourished with breast milk scored significantly higher than those who were formula-fed. Breast was best.

No single experiment is conclusive, of course. But randomly assigning participants to one feeding group or the other effectively eliminated all factors except nutrition. If test performance changes when we vary infant nutrition, then we infer that nutrition matters.

The point to remember: Unlike correlational studies, which uncover naturally occurring relationships, an experiment manipulates a factor to determine its effect.

PROCEDURES AND THE PLACEBO EFFECT Consider, then, how we might assess therapeutic interventions. Our tendency to seek new remedies when we are ill or emotionally down can produce misleading testimonies. If three days into a cold we start taking zinc tablets and find our cold symptoms lessening, we may credit the pills rather than the cold naturally subsiding. In the 1700s, bloodletting *seemed* effective. People sometimes improved after the treatment; when they didn't, the practitioner inferred the disease was too advanced to be reversed. So, whether or not a remedy is truly effective, enthusiastic users will probably endorse it. To determine its effect, we must control for other factors.

And that is precisely how new drugs and new methods of psychological therapy are evaluated (Chapter 16). Investigators randomly assign participants in these studies to research groups. One group receives a treatment (such as a medication). The other group receives a pseudotreatment—an inert *placebo* (perhaps a pill with no drug in it). The participants are often *blind* (uninformed) about what treatment, if any, they are receiving. If the study is using a **double-blind procedure**, neither the participants nor those who administer the drug and collect the data will know which group is receiving the treatment.

experiment a research method in which an investigator manipulates one or more factors (independent variables) to observe the effect on some behavior or mental process (the dependent variable). By *random assignment* of participants, the experimenter aims to control other relevant factors.

experimental group in an experiment, the group exposed to the treatment, that is, to one version of the independent variable.

control group in an experiment, the group *not* exposed to the treatment; contrasts with the experimental group and serves as a comparison for evaluating the effect of the treatment.

random assignment assigning participants to experimental and control groups by chance, thus minimizing preexisting differences between the different groups.

double-blind procedure an experimental procedure in which both the research participants and the research staff are ignorant (blind) about whether the research participants have received the treatment or a placebo. Commonly used in drug-evaluation studies.

In double-blind studies, researchers check a treatment's actual effects apart from the participants' and the staff's belief in its healing powers. Just *thinking* you are getting a treatment can boost your spirits, relax your body, and relieve your symptoms. This **placebo effect** is well documented in reducing pain, depression, and anxiety (Kirsch, 2010). Athletes have run faster when given a supposed performance-enhancing drug (McClung & Collins, 2007). Decaf-coffee drinkers have reported increased vigor and alertness—when they thought their brew had caffeine in it (Dawkins et al., 2011). People have felt better after receiving a phony mood-enhancing drug (Michael et al., 2012). And the more expensive the placebo, the more "real" it seems to us—a fake pill that costs $2.50 worked better than one costing 10 cents (Waber et al., 2008). To know how effective a therapy really is, researchers must control for a possible placebo effect.

placebo [pluh-SEE-bo; Latin for "I shall please"] **effect** experimental results caused by expectations alone; any effect on behavior caused by the administration of an inert substance or condition, which the recipient assumes is an active agent.

independent variable in an experiment, the factor that is manipulated; the variable whose effect is being studied.

confounding variable a factor other than the factor being studied that might influence a study's results.

dependent variable in an experiment, the outcome that is measured; the variable that may change when the independent variable is manipulated.

RETRIEVAL PRACTICE

RP-10 What measures do researchers use to prevent the *placebo effect* from confusing their results?

INDEPENDENT AND DEPENDENT VARIABLES Here is an even more potent example: The drug Viagra was approved for use after 21 clinical trials. One trial was an experiment in which researchers randomly assigned 329 men with erectile disorder to either an experimental group (Viagra takers) or a control group (placebo takers given an identical-looking pill). The procedure was double-blind—neither the men taking the pills nor the person giving them knew what they were receiving. The result: At peak doses, 69 percent of Viagra-assisted attempts at intercourse were successful, compared with 22 percent for men receiving the placebo (Goldstein et al., 1998). Viagra performed.

This simple experiment manipulated just one factor: the drug (Viagra versus no Viagra). We call this experimental factor the **independent variable** because we can vary it *independently* of other factors, such as the men's age, weight, and personality. Other factors that can potentially influence a study's results are called **confounding variables**. Random assignment controls for possible confounding variables.

A similar experiment on a drug approved to increase women's sexual arousal produced a result described as, um, anticlimactic—an additional "half of one satisfying sexual encounter a month" (Ness, 2016; Tavernise, 2016).

Experiments examine the effect of one or more independent variables on some measurable behavior, called the **dependent variable** because it can vary *depending* on what takes place during the experiment. Both variables are given precise *operational definitions*, which specify the procedures that manipulate the independent variable (the exact drug dosage and timing in this study) or measure the dependent variable (the men's responses to questions about their sexual performance). These definitions answer the "What do you mean?" question with a level of precision that enables others to replicate the study. (See **FIGURE 1.5** for the British breast-milk experiment's design.)

Let's pause to check your understanding using a simple psychology experiment: To test the effect of perceived ethnicity on the availability of rental housing, Adrian Carpusor and William Loges (2006) sent identically worded e-mail inquiries to 1115 Los Angeles–area landlords. The researchers varied the ethnic connotation of the sender's name and tracked the percentage of landlords' positive replies (invitations to view the apartment in person). "Patrick McDougall," "Said Al-Rahman," and "Tyrell Jackson" received, respectively, 89 percent, 66 percent, and 56 percent invitations. In this experiment, what was the independent variable? The dependent variable?[3]

"[We must guard] against not just racial slurs, but . . . against the subtle impulse to call Johnny back for a job interview, but not Jamal."

U.S. President Barack Obama, Eulogy for Clementa Pinckney, June 26, 2015

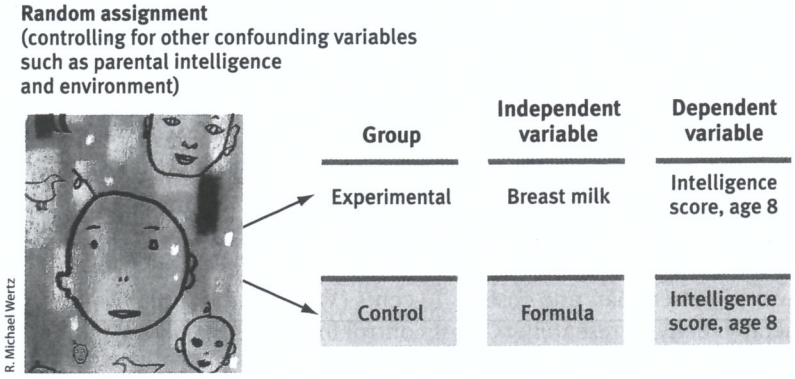
Experiments can also help us evaluate social programs. Do early childhood education programs boost impoverished children's chances for success? What are the effects of different antismoking campaigns? Do school sex-education programs reduce teen

RETRIEVAL PRACTICE ANSWER

RP-10 Research designed to prevent the placebo effect randomly assigns participants to an *experimental group* (which receives the real treatment) or to a *control group* (which receives a placebo). A double-blind procedure prevents people's beliefs and hopes from affecting the results, because neither the participants nor those collecting the data know who receives the placebo. A comparison of the results will demonstrate whether the real treatment produces better results than *belief* in that treatment.

OTHER FOOTNOTE

[3] The independent variable, which the researchers manipulated, was the implied ethnicity of the applicants' names. The dependent variable, which researchers measured, was the rate of positive responses from the landlords.



▶ FIGURE 1.5
Experimentation To discern causation, psychologists control for confounding variables by randomly assigning some participants to an experimental group, and others to a control group. Measuring the dependent variable (later intelligence test score) will determine the effect of the independent variable (type of milk).

pregnancies? To answer such questions, we can experiment: If an intervention is welcomed but resources are scarce, we could use a lottery to randomly assign some people (or regions) to experience the new program and others to a control condition. If later the two groups differ, the intervention's effect will be supported (Passell, 1993).

Let's recap. A *variable* is anything that can vary (infant nutrition, intelligence, TV exposure—anything within the bounds of what is feasible and ethical to measure). Experiments aim to *manipulate* an *independent* variable, *measure* a *dependent* variable, and control *confounding* variables. An experiment has at least two different conditions: an *experimental condition* and a *comparison* or *control condition*. *Random assignment* works to minimize preexisting differences between the groups before any treatment effects occur. In this way, an experiment tests the effect of at least one independent variable (what we manipulate) on at least one dependent variable (the outcome we measure).

"If I don't think it's going to work, will it still work?"

RETRIEVAL PRACTICE

RP-11 By using *random assignment*, researchers are able to control for _____ _____, which are other factors besides the independent variable(s) that may influence research results.

RP-12 Match the term on the left with the description on the right.

1. double-blind procedure
2. random sampling
3. random assignment

a. helps researchers generalize from a small set of survey responses to a larger population
b. helps minimize preexisting differences between experimental and control groups
c. controls for the placebo effect; neither researchers nor participants know who receives the real treatment

RP-13 Why, when testing a new drug to control blood pressure, would we learn more about its effectiveness from giving it to half of the participants in a group of 1000 than to all 1000 participants?

See the **Videos: Experiments** and **Confounding Variables** for helpful tutorial animations.

RETRIEVAL PRACTICE ANSWERS

RP-11 confounding variables **RP-12** 1. c, 2. a, 3. b **RP-13** We learn more about the drug's effectiveness when we can compare the results of those who took the drug (the experimental group) with the results of those who did not (the control group). If we gave the drug to all 1000 participants, we would have no way of knowing whether the drug is serving as a placebo or is actually medically effective.

Research Design

LOQ 1-8 How would you know which research design to use?

Throughout this book, you will read about amazing psychological science discoveries. But how do we know fact from fiction? How do psychological scientists choose research methods and design their studies in ways that provide meaningful results? Understanding how research is done—how testable questions are developed and studied—is key to appreciating all of psychology. **TABLE 1.2** compares the features of psychology's main research methods. In later chapters, you will read about other research designs, including *twin studies* (Chapter 4) and *cross-sectional* and *longitudinal research* (Chapter 10).

In psychological research, no questions are off limits, except untestable ones: Does free will exist? Are people born evil? Is there an afterlife? Psychologists can't test those questions. But they *can* test whether free will beliefs, aggressive personalities, and a belief in life after death influence how people think, feel, and act (Dechesne et al., 2003; Shariff et al., 2014; Webster et al., 2014).

TABLE 1.2
Comparing Research Methods

Research Method	Basic Purpose	How Conducted	What Is Manipulated	Weaknesses
Descriptive	To observe and record behavior	Do case studies, naturalistic observations, or surveys	Nothing	No control of variables; single cases may be misleading
Correlational	To detect naturally occurring relationships; to assess how well one variable predicts another	Collect data on two or more variables; no manipulation	Nothing	Cannot specify cause and effect
Experimental	To explore cause and effect	Manipulate one or more factors; use random assignment	The independent variable(s)	Sometimes not feasible; results may not generalize to other contexts; not ethical to manipulate certain variables

Having chosen their question, psychologists then select the most appropriate research design—*experimental, correlational, case study, naturalistic observation, twin study, longitudinal,* or *cross-sectional*—and determine how to set it up most effectively. They consider how much money and time are available, ethical issues, and other limitations. For example, it wouldn't be ethical for a researcher studying child development to use the experimental method and randomly assign children to loving versus punishing homes.

Next, psychological scientists decide how to measure the behavior or mental process being studied. For example, researchers could measure aggressive behavior by measuring participants' willingness to blast a stranger with intense noise.

Researchers want to have confidence in their findings, so they carefully consider confounding variables—factors other than those being studied that may affect their interpretation of results.

Psychological research is a creative adventure. Researchers *design* each study, *measure* target behaviors, *interpret* results, and learn more about the fascinating world of behavior and mental processes along the way.

To review and test your understanding of research methods, visit **Concept Practice: Psychology's Research Methods and The Language of Experiments**, and the interactive **PsychSim 6: Understanding Psychological Research**. For a 9.5-minute synopsis of psychology's scientific research strategies, see the **Video: Research Methods**.

To help you build your understanding, your critical thinking, and your *scientific literacy skills*, we created online Immersive Learning research activities. In these "How Would You Know?" activities, you get to play the role of the researcher, making choices about the best ways to test interesting questions. Some examples: How Would You Know If Having Children Relates to Being Happier?, How Would You Know If a Cup of Coffee Can Warm Up Relationships?, and How Would You Know If People Can Learn to Reduce Anxiety?

Predicting Everyday Behavior

LOQ 1-9 How can simplified laboratory conditions illuminate everyday life?

When you see or hear about psychological research, do you ever wonder whether people's behavior in the lab will predict their behavior in everyday life? Does detecting the blink of a faint red light in a dark room say anything useful about flying a plane at night? After viewing a violent, sexually explicit film, does a man's increased willingness to push buttons that deliver a noise blast to a woman really say anything about whether viewing violent pornography makes a man more likely to abuse a woman?

Before you answer, consider: The experimenter *intends* the laboratory environment to be a simplified reality—one that simulates and controls important features of everyday life. Just as a wind tunnel lets airplane designers re-create airflow forces under controlled conditions, a laboratory experiment lets psychologists re-create psychological forces under controlled conditions.

An experiment's purpose is not to re-create the exact behaviors of everyday life, but to test *theoretical principles* (Mook, 1983). In aggression studies, deciding whether to push a button that delivers a noise blast may not be the same as slapping someone in the face, but the principle is the same. *It is the resulting principles—not the specific findings—that help explain everyday behaviors.*

When psychologists apply laboratory research on aggression to actual violence, they are applying theoretical principles of aggressive behavior, principles they have refined through many experiments. Similarly, it is the principles of the visual system, developed from experiments in artificial settings (such as looking at red lights in the dark), that researchers apply to more complex behaviors such as night flying. And many investigations show that principles derived in the laboratory do typically generalize to the everyday world (Anderson et al., 1999).

The point to remember: Psychological science focuses less on specific behaviors than on revealing general principles that help explain many behaviors.

Psychology's Research Ethics

LOQ 1-10 Why do psychologists study animals, and what ethical guidelines safeguard human and animal research participants? How do psychologists' values influence psychology?

We have reflected on how a scientific approach can restrain biases. We have seen how case studies, naturalistic observations, and surveys help us describe behavior. We have also noted that correlational studies assess the association between two factors, showing how well one predicts another. We have examined the logic that underlies experiments, which use control conditions and random assignment of participants to isolate the effects of an independent variable on a dependent variable.

Yet, even knowing this much, you may still be approaching psychology with a mixture of curiosity and apprehension. So before we plunge in, let's entertain some common questions about psychology's ethics and values.

See the **Video: Research Ethics** for a helpful tutorial animation.

informed consent giving potential participants enough information about a study to enable them to choose whether they wish to participate.

debriefing the postexperimental explanation of a study, including its purpose and any deceptions, to its participants.

Protecting Research Participants

STUDYING AND PROTECTING ANIMALS Many psychologists study nonhuman animals because they find them fascinating. They want to understand how different species learn, think, and behave. Psychologists also study animals to learn about people. We humans are not *like* animals; we *are* animals, sharing a common biology. Animal experiments have therefore led to treatments for human diseases—insulin for diabetes, vaccines to prevent polio and rabies, transplants to replace defective organs.

Humans are complex. But the same processes by which we learn are present in rats, monkeys, and even sea slugs. The simplicity of the sea slug's nervous system is precisely what makes it so revealing of the neural mechanisms of learning.

Sharing such similarities, should we not respect our animal relatives? The animal protection movement protests the use of animals in psychological, biological, and medical research. "We cannot defend our scientific work with animals on the basis of the similarities between them and ourselves and then defend it morally on the basis of differences," noted Roger Ulrich (1991).

"Rats are very similar to humans except that they are not stupid enough to purchase lottery tickets."
Dave Barry, July 2, 2002

Out of this heated debate, two issues emerge. The basic one is whether it is right to place the well-being of humans above that of other animals. In experiments on stress and cancer, is it right that mice get tumors in the hope that people might not? Should some monkeys be exposed to an HIV-like virus in the search for an AIDS vaccine? Humans raise and slaughter 56 billion animals a year (Worldwatch Institute, 2013). Is our use and consumption of other animals as natural as the behavior of carnivorous hawks, cats, and whales?

"Please do not forget those of us who suffer from incurable diseases or disabilities who hope for a cure through research that requires the use of animals."
Psychologist Dennis Feeney (1987)

For those who give human life top priority, a second question emerges: What safeguards should protect the well-being of animals in research? One survey of animal researchers gave an answer. Some 98 percent supported government regulations protecting primates, dogs, and cats, and 74 percent also supported regulations providing for the humane care of rats and mice (Plous & Herzog, 2000). Many professional associations and funding agencies already have such guidelines. British Psychological Society (BPS) guidelines call for housing animals under reasonably natural living conditions, with companions for social animals (Lea, 2000). American Psychological Association (APA) guidelines state that researchers must provide "humane care and healthful conditions" and that testing should "minimize discomfort" (APA, 2012). The European Parliament also mandates standards for animal care and housing (Vogel, 2010). Most universities screen research proposals, often through an animal care ethics committee, and laboratories are regulated and inspected.

"The greatness of a nation can be judged by the way its animals are treated."
Mahatma Gandhi, 1869–1948

Animals have themselves benefited from animal research. One Ohio team of research psychologists measured stress hormone levels in samples of millions of dogs brought each year to animal shelters. They devised handling and stroking methods to reduce stress and ease the dogs' transition to adoptive homes (Tuber et al., 1999). Other studies have helped improve care and management in animals' natural habitats. By revealing our behavioral kinship with animals and the remarkable intelligence of chimpanzees, gorillas, and other animals, experiments have also led to increased empathy and protection for them. At its best, a psychology concerned for humans and sensitive to animals serves the welfare of both.

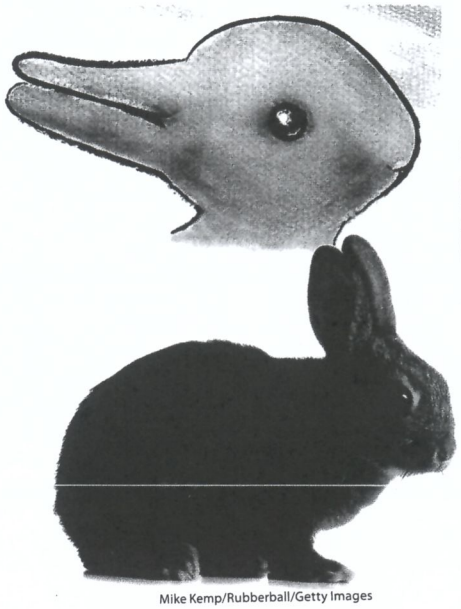
Animal research benefiting animals Psychologists have helped zoos enrich animal environments, such as by reducing the "learned helplessness" of captivity by giving animals more choices (Kurtycz, 2015; Weir, 2013). Thanks partly to research on the benefits of novelty, control, and stimulation, these gorillas are enjoying an improved quality of life in New York's Bronx Zoo.

MARY ALTAFFER/AP Images

STUDYING AND PROTECTING HUMANS What about human participants? Does the image of white-coated scientists seeming to deliver electric shocks trouble you? Actually, most psychological studies are free of such stress. Blinking lights, flashing words, and pleasant social interactions are more common. Moreover, psychology's experiments are mild compared with the stress and humiliation often inflicted in reality TV "experiments." In one episode of *The Bachelor,* a man dumped his new fiancée on camera, at the producers' request, for the woman who earlier had finished second (Collins, 2009).

Occasionally, though, researchers do temporarily stress or deceive people, but only when they believe it is essential to a justifiable end, such as understanding and controlling violent behavior or studying mood swings. Some experiments won't work if participants know everything beforehand. (Wanting to be helpful, the participants might try to confirm the researcher's predictions.)

The ethics codes of the APA and Britain's BPS urge researchers to (1) obtain potential participants' **informed consent** to take part, (2) protect participants from greater-than-usual harm and discomfort, (3) keep information about individual participants confidential, and (4) fully **debrief** people (explain the research afterward). As with nonhuman animals, most university ethics committees have guidelines that screen research proposals and safeguard human participants' well-being.



Mike Kemp/Rubberball/Getty Images

"There can be no peace until they renounce their Rabbit God and accept our Duck God."

▶ FIGURE 1.6
What do you see? Our expectations influence what we perceive. Did you see a duck or a rabbit? Show some friends this image with the rabbit photo covered up and see if they are more likely to perceive a duck instead. (Inspired by Shepard, 1990.)

Values in Psychology

Values affect what we study, how we study it, and how we interpret results. Researchers' values influence choice of research topics. Should we study worker productivity or worker morale? Sex discrimination or gender differences? Conformity or independence? Values can also color "the facts"—our observations and interpretations; sometimes we see what we want or expect to see (**FIGURE 1.6**).

Even the words we use to describe traits and tendencies can reflect our values. In psychology and in everyday speech, labels describe and labels evaluate: One person's *rigidity* is another's *consistency*. One person's *undocumented worker* is another's *illegal alien*. One person's *faith* is another's *fanaticism*. One country's *enhanced interrogation techniques* become *torture* when practiced by an enemy. Our labeling someone as *firm* or *stubborn*, *careful* or *picky*, *discreet* or *secretive* reveals our own attitudes.

Popular applications of psychology also contain hidden values. If you defer to "professional" guidance about how to live—how to raise children, how to achieve self-fulfillment, how to respond to sexual feelings, how to get ahead at work—you are accepting value-laden advice. A science of behavior and mental processes can help us reach our goals. But it cannot decide what those goals should be.

If some people see psychology as merely common sense, others have a different concern—that it is becoming dangerously powerful. Might psychology be used to manipulate people?

Knowledge, like all power, can be used for good or evil. Nuclear power has been used to light up cities—and to demolish them. Persuasive power has been used to educate people—and to deceive them. Although psychology does have the power to deceive, its purpose is to enlighten. Every day, psychologists explore ways to enhance learning, creativity, and compassion. Psychology speaks to many of our world's great problems—war, overpopulation, prejudice, family crises, crime—all of which involve attitudes and behaviors. Psychology also speaks to our deepest longings—for nourishment, for love, for happiness. Psychology cannot address all of life's great questions, but it speaks to some mighty important ones.

Psychology speaks In making its historic 1954 school desegregation decision, the U.S. Supreme Court cited the expert testimony and research of psychologists Kenneth Clark and Mamie Phipps Clark (1947). The Clarks reported that, when given a choice between Black and White dolls, most African-American children chose the White doll, which seemingly indicated internalized anti-Black prejudice.

RETRIEVAL PRACTICE

RP-14 How are animal subjects and human research participants protected?

RETRIEVAL PRACTICE ANSWER

RP-14 Animal protection legislation, laboratory regulation and inspection, and local and university ethics committees (which screen research proposals) attempt to safeguard animal welfare. International psychological organizations urge researchers involving human participants to obtain *informed consent*, protect them from greater-than-usual harm and discomfort, treat their personal information confidentially, and *debrief* them fully at the end of the experiment.

REVIEW Research Strategies: How Psychologists Ask and Answer Questions

LEARNING OBJECTIVES

Test yourself by taking a moment to answer each of these Learning Objective Questions (repeated here from within this section). Then check your answer—a click away in the e-book, and in Appendix C of the printed text. Research suggests that trying to answer these questions on your own will improve your long-term retention (McDaniel et al., 2009, 2015).

LOQ 1-1 How does our everyday thinking sometimes lead us to a wrong conclusion?

LOQ 1-2 How do theories advance psychological science?

LOQ 1-3 How do psychologists use case studies, naturalistic observations, and surveys to observe and describe behavior, and why is random sampling important?

LOQ 1-4 What does it mean when we say two things are correlated, and what are positive and negative correlations?

LOQ 1-5 What are illusory correlations, and what is regression toward the mean?

LOQ 1-6 Why do correlations enable prediction but not cause-effect explanation?

LOQ 1-7 What are the characteristics of experimentation that make it possible to isolate cause and effect?

LOQ 1-8 How would you know which research design to use?

LOQ 1-9 How can simplified laboratory conditions illuminate everyday life?

LOQ 1-10 Why do psychologists study animals, and what ethical guidelines safeguard human and animal research participants? How do psychologists' values influence psychology?

TERMS AND CONCEPTS TO REMEMBER

Test yourself on these terms by trying to compose the definition before checking your answers.

hindsight bias, p. 22
theory, p. 24
hypothesis, p. 24
operational definition, p. 24
replication, p. 24
case study, p. 26
naturalistic observation, p. 26
survey, p. 29
random sample, p. 29
population, p. 29
correlation, p. 29
correlation coefficient, p. 29
variable, p. 31
scatterplot, p. 31
illusory correlation, p. 31
regression toward the mean, p. 32
experiment, p. 34
experimental group, p. 34
control group, p. 34
random assignment, p. 34
double-blind procedure, p. 34
placebo [pluh-SEE-bo] effect, p. 35
independent variable, p. 35
confounding variable, p. 35
dependent variable, p. 35
informed consent, p. 38
debriefing, p. 38

MASTER THE MATERIAL

Test yourself repeatedly throughout your studies. This will not only help you figure out what you know and don't know; the testing itself will help you learn and remember the information more effectively thanks to the *testing effect*.

1. _____ _____ refers to our tendency to perceive events as obvious or inevitable after the fact.
2. As scientists, psychologists
   - **a.** keep their methods private so others will not repeat their research.
   - **b.** assume the truth of articles published in leading scientific journals.
   - **c.** reject evidence that competes with traditional findings.
   - **d.** are willing to ask questions and to reject claims that cannot be verified by research.
3. Theory-based predictions are called _____.
4. Which of the following is NOT one of the *descriptive* methods psychologists use to observe and describe behavior?
   - **a.** A case study
   - **b.** Naturalistic observation
   - **c.** Correlational research
   - **d.** A phone survey
5. For your survey, you need to establish a group of people who represent the country's entire adult population. To do this, you will need to question a _____ sample of the population.
6. A study finds that the more childbirth training classes women attend, the less pain medication they require during childbirth. This finding can be stated as a _____ (positive/negative) correlation.
7. A _____ provides a visual representation of the direction and the strength of a relationship between two variables.
8. In a _____ correlation, the scores rise and fall together; in a _____ correlation, one score falls as the other rises.
   - **a.** positive; negative
   - **b.** positive; illusory
   - **c.** negative; weak
   - **d.** strong; weak

9. What is regression toward the mean, and how can it influence our interpretation of events?
10. Knowing that two events are correlated provides
    a. a basis for prediction.
    b. an explanation of why the events are related.
    c. proof that as one increases, the other also increases.
    d. an indication that an underlying third factor is at work.
11. Here are some recently reported correlations, with interpretations drawn by journalists. Knowing just these correlations, can you come up with other possible explanations for each of these?
    a. Alcohol use is associated with violence. (One interpretation: Drinking triggers or unleashes aggressive behavior.)
    b. Educated people live longer, on average, than less-educated people. (One interpretation: Education lengthens life and enhances health.)
    c. Teens engaged in team sports are less likely to use drugs, smoke, have sex, carry weapons, and eat junk food than are teens who do not engage in team sports. (One interpretation: Team sports encourage healthy living.)
    d. Adolescents who frequently see smoking in movies are more likely to smoke. (One interpretation: Movie stars' behavior influences impressionable teens.)
12. To explain behaviors and clarify cause and effect, psychologists use _____.
13. To test the effect of a new drug on depression, we randomly assign people to control and experimental groups. Those in the control group take a pill that contains no medication. This pill is a _____.
14. In a double-blind procedure,
    a. only the participants know whether they are in the control group or the experimental group.
    b. experimental and control group members will be carefully matched for age, sex, income, and education level.
    c. neither the participants nor the researchers know who is in the experimental group or control group.
    d. someone separate from the researcher will ask people to volunteer for the experimental group or the control group.
15. A researcher wants to determine whether noise level affects workers' blood pressure. In one group, she varies the level of noise in the environment and records participants' blood pressure. In this experiment, the level of noise is the _____.
16. The laboratory environment is designed to
    a. exactly re-create the events of everyday life.
    b. re-create psychological forces under *controlled* conditions.
    c. re-create psychological forces under *random* conditions.
    d. minimize the use of animals and humans in psychological research.
17. In defending their experimental research with animals, psychologists have noted that
    a. animals' physiology and behavior can tell us much about our own.
    b. animal experimentation sometimes helps animals as well as humans.
    c. animals are fascinating creatures and worthy of study.
    d. all of these statements are correct.

Answers are a click away in the e-book, and available in Appendix D at the back of the printed text.

Use LearningCurve to create your personalized study plan, which will direct you to the Macmillan resources that will help you most.

Statistical Reasoning in Everyday Life

In descriptive, correlational, and experimental research, statistics are tools that help us see and interpret what the unaided eye might miss. But accurate statistical understanding benefits everyone. To be an educated person today is to be able to apply simple statistical principles to everyday reasoning. One needn't memorize complicated formulas to think more clearly and critically about data.

Off-the-top-of-the-head estimates often misread reality and mislead the public. Someone throws out a big, round number. Others echo it, and before long the big, round number becomes public misinformation. Two examples:

- *Ten percent of people are gay or lesbian.* Or is it 2 to 4 percent, as suggested by various national surveys (Chapter 11)?
- *We ordinarily use only 10 percent of our brain.* Or is it closer to 100 percent (Chapter 2)?

The point to remember: Doubt big, round, undocumented numbers. If you read that there are one million missing children, two million homeless, or three million spouse abusers, you can be pretty sure that someone is guessing. If they to want emphasize the

When setting goals, we love big, round numbers. We're far more likely to want to lose 20 pounds than 19 or 21 pounds (or an even 10 kilograms rather than 9.07 kilograms). And by modifying their behavior, batters are nearly four times more likely to finish the season with a .300 average than with a .299 average (Pope & Simonsohn, 2011).

problem, they will be motivated to guess big. If they want to minimize the problem, they will guess small.

Statistical illiteracy also feeds needless health scares (Gigerenzer, 2010). In the 1990s, the British press reported a study showing that women taking a particular contraceptive pill had a 100 percent increased risk of blood clots that could produce strokes. This caused thousands of women to stop taking the pill, leading to a wave of unwanted pregnancies and an estimated 13,000 additional abortions (which also are associated with increased blood-clot risk). And what did the study actually find? A 100 percent increased risk, indeed—but only from 1 in 7000 to 2 in 7000. Such false alarms underscore the need to teach statistical reasoning and to present statistical information more transparently.

"Figures can be misleading—so I've written a song which I think expresses the real story of the firm's performance this quarter."

Describing Data

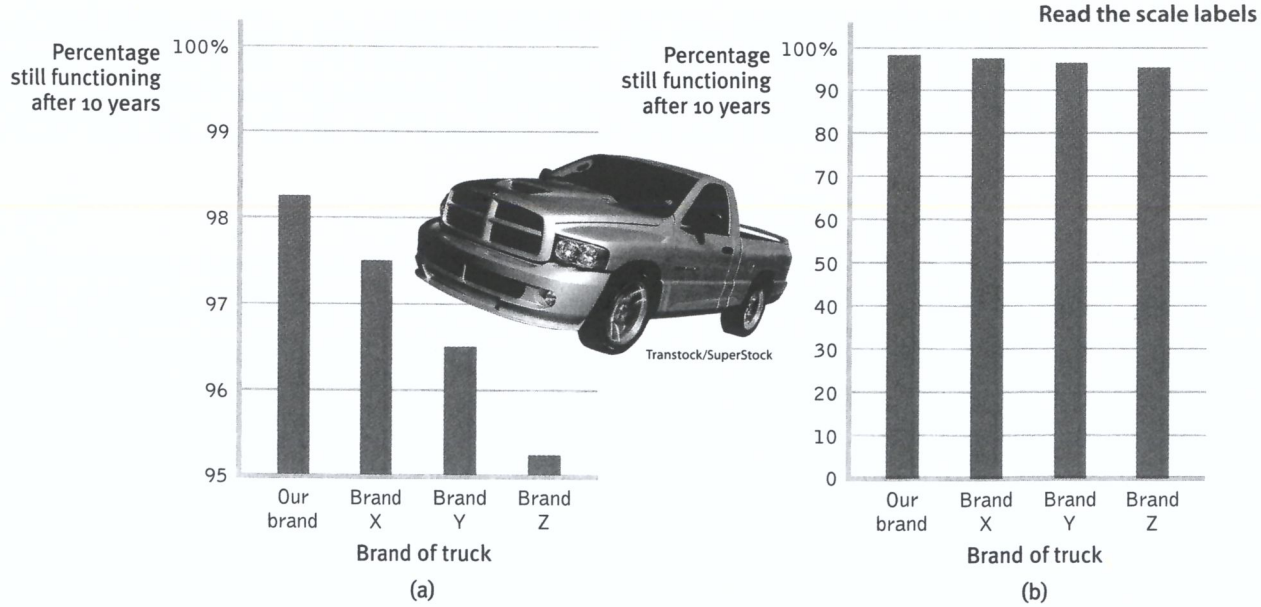
LOQ 1-11 How do we describe data using three measures of central tendency, and what is the relative usefulness of the two measures of variation?

Once researchers have gathered their data, they may organize the data using *descriptive statistics*. One way to do this is to convert the data into a simple *bar graph*, as in **FIGURE 1.7**, which displays a distribution of different brands of trucks still on the road after a decade. When reading statistical graphs such as this one, take care. It's easy to design a graph to make a difference look big (Figure 1.7a) or small (Figure 1.7b). The secret lies in how you label the vertical scale (the *y-axis*).

RETRIEVAL PRACTICE

RP-15 An American truck manufacturer offered graph (a) below—with actual brand names included—to suggest the much greater durability of its trucks. What does graph (b) make clear about the varying durability, and how is this accomplished?

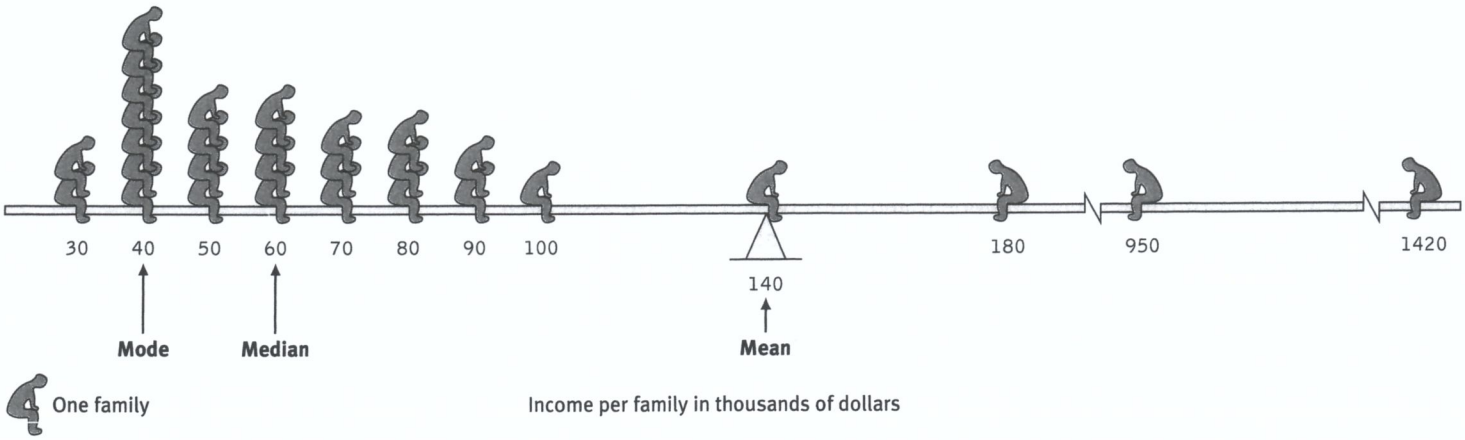
▼ FIGURE 1.7
Read the scale labels



The point to remember: Think smart. When viewing graphs, read the scale labels and note their range.

RETRIEVAL PRACTICE ANSWER

RP-15 Note how the *y*-axis of each graph is labeled. The range for the *y*-axis label in graph (a) is only from 95 to 100. The range for graph (b) is from 0 to 100. All the trucks rank as 95% and up, so almost all are still functioning after 10 years, which graph (b) makes clear.



▲ FIGURE 1.8
A skewed distribution This graphic representation of the distribution of a village's incomes illustrates the three measures of central tendency—mode, median, and mean. Note how just a few high incomes make the mean—the fulcrum point that balances the incomes above and below—deceptively high.

Measures of Central Tendency

The next step is to summarize the data using some *measure of central tendency*, a single score that represents a whole set of scores. The simplest measure is the **mode**, the most frequently occurring score or scores. The most familiar is the **mean**, or arithmetic average—the total sum of all the scores divided by the number of scores. The midpoint—the 50th percentile—is the **median**. On a divided highway, the median is the middle. So, too, with data: If you arrange all the scores in order from the highest to the lowest, half will be above the median and half will be below it.

Measures of central tendency neatly summarize data. But consider what happens to the mean when a distribution is lopsided, when it's *skewed* by a few way-out scores. With income data, for example, the mode, median, and mean often tell very different stories (**FIGURE 1.8**). This happens because the mean is biased by a few extreme incomes. When Microsoft co-founder Bill Gates sits down in an intimate café, its average (mean) customer instantly becomes a billionaire. But the median customer's wealth remains unchanged. Understanding this, you can see why, according to the 2010 U.S. Census, nearly 65 percent of U.S. households have "below average" income. The bottom half of earners receive much less than half the national income cake. So, most Americans make less than average (the mean). Mean and median tell different true stories.

The average person has one ovary and one testicle.

The point to remember: Always note which measure of central tendency is reported. If it is a mean, consider whether a few atypical scores could be distorting it.

Measures of Variation

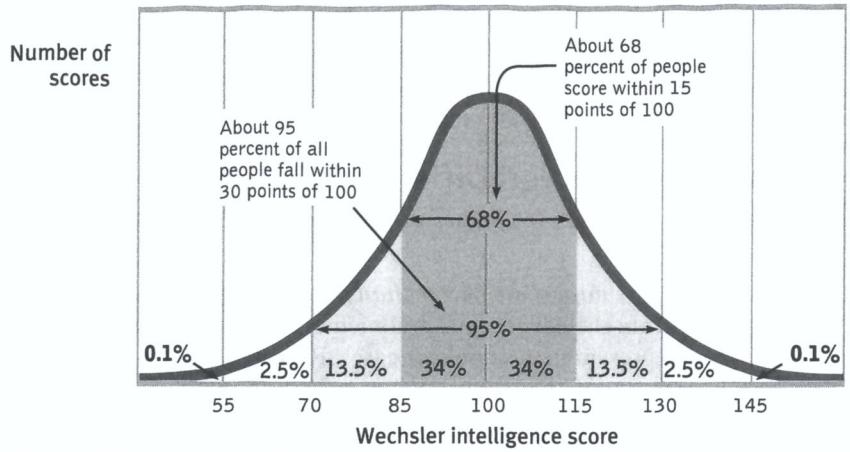
Knowing the value of an appropriate measure of central tendency can tell us a great deal. But the single number omits other information. It helps to know something about the amount of *variation* in the data—how similar or diverse the scores are. Averages derived from scores with low variability are more reliable than averages based on scores with high variability. Consider a basketball player who scored between 13 and 17 points in each of the season's first 10 games. Knowing this, we would be more confident that she would score near 15 points in her next game than if her scores had varied from 5 to 25 points.

The **range** of scores—the gap between the lowest and highest—provides only a crude estimate of variation. A couple of extreme scores in an otherwise similar group, such as the $950,000 and $1,420,000 incomes in Figure 1.8, will create a deceptively large range.

The more useful standard for measuring how much scores deviate from one another is the **standard deviation**. It better gauges whether scores are packed together or dispersed, because it uses information from each score. The computation[4] assembles information about how much individual scores differ from the mean, which can be

OTHER FOOTNOTE

[4] The actual standard deviation formula: $\sqrt{\frac{\text{Sum of (deviations from mean)}^2}{\text{Number of scores}}}$



◀ FIGURE 1.9
The normal curve Scores on aptitude tests tend to form a normal, or bell-shaped, curve. For example, the most commonly used intelligence test, the Wechsler Adult Intelligence Scale, calls the average score 100.

very telling. Let's say test scores from Class A and Class B both have the same mean (75 percent correct), but very different standard deviations (5.0 for Class A and 15.0 for Class B). Have you ever had test experiences like that—where two-thirds of your classmates in one course score in the 70 to 80 percent range, with scores in another course more spread out (two-thirds between 60 and 90)? The standard deviation, as well as the mean score, tell us about how each class is faring.

You can grasp the meaning of the standard deviation if you consider how scores naturally tend to be distributed in nature. Large numbers of data—heights, intelligence scores, life expectancy (though not incomes)—often form a symmetrical, *bell-shaped* distribution. Most cases fall near the mean, and fewer cases fall near either extreme. This bell-shaped distribution is so typical that we call the curve it forms the **normal curve**.

As **FIGURE 1.9** shows, a useful property of the normal curve is that roughly 68 percent of the cases fall within one standard deviation on either side of the mean. About 95 percent of cases fall within two standard deviations. Thus, as Chapter 10 notes, about 68 percent of people taking an intelligence test will score within ±15 points of 100. About 95 percent will score within ±30 points.

RETRIEVAL PRACTICE

RP-16 The average of a distribution of scores is the _____. The score that shows up most often is the _____. The score right in the middle of a distribution (half the scores above it; half below) is the _____. We determine how much scores vary around the average in a way that includes information about the _____ of scores (difference between highest and lowest) by using the _____ _____ formula.

For an interactive tutorial on these statistical concepts, visit **PsychSim 6: Descriptive Statistics.**

Significant Differences

LOQ 1-12 How do we know whether an observed difference can be generalized to other populations?

Data are "noisy." The average score in one group (children who were breast-fed as babies) could conceivably differ from the average score in another group (children who were bottle-fed) not because of any real difference but merely because of chance fluctuations

RETRIEVAL PRACTICE ANSWER

RP-16 mean; mode; median; range; standard deviation

mode the most frequently occurring score(s) in a distribution.

mean the arithmetic average of a distribution, obtained by adding the scores and then dividing by the number of scores.

median the middle score in a distribution; half the scores are above it and half are below it.

range the difference between the highest and lowest scores in a distribution.

standard deviation a computed measure of how much scores vary around the mean score.

normal curve *(normal distribution)* a symmetrical, bell-shaped curve that describes the distribution of many types of data; most scores fall near the mean (about 68 percent fall within one standard deviation of it) and fewer and fewer near the extremes.

"The poor are getting poorer, but with the rich getting richer it all averages out in the long run."

in the people sampled. How confidently, then, can we infer that an observed difference is not just a fluke—a chance result from the research sample? For guidance, we can ask how reliable and statistically significant the differences are. These *inferential statistics* help us determine if results can be generalized to a larger population.

When Is an Observed Difference Reliable?

In deciding when it is safe to generalize from a sample, we should keep three principles in mind:

1. ***Representative samples are better than biased samples.*** The best basis for generalizing is not from the exceptional and memorable cases one finds at the extremes but from a representative sample of cases. Research never randomly samples the whole human population. Thus, it pays to keep in mind what population a study has sampled.
2. ***Less-variable observations are more reliable than those that are more variable.*** As we noted earlier in the example of the basketball player whose game-to-game points were consistent, an average is more reliable when it comes from scores with low variability.
3. ***More cases are better than fewer.*** An eager prospective student visits two university campuses, each for a day. At the first, the student randomly attends two classes and discovers both instructors to be witty and engaging. At the next campus, the two sampled instructors seem dull and uninspiring. Returning home, the student (discounting the small sample size of only two teachers at each institution) tells friends about the "great teachers" at the first school and the "bores" at the second. Again, we know it but we ignore it: *Averages based on many cases are more reliable* (less variable) than averages based on only a few cases. After noticing that small schools were overrepresented among the most successful schools, several foundations invested in splitting larger schools into smaller ones—without realizing that small schools were also overrepresented among the *least* successful, because schools with fewer students have more variable outcomes (Nisbett, 2015). Again, more cases make for a more reliable average.

The point to remember: Smart thinkers are not overly impressed by a few anecdotes. Generalizations based on a few unrepresentative cases are unreliable.

When Is an Observed Difference Significant?

Perhaps you've compared men's and women's scores on a laboratory test of aggression, and found a gender difference. But individuals differ. How likely is it that the difference you observed was just a fluke? Statistical testing can estimate that.

Here is the underlying logic: When averages from two samples are each reliable measures of their respective populations (as when each is based on many observations that have small variability), then their *difference* is probably reliable as well. (Example: The less the variability in women's and in men's aggression scores, the more confidence we would have that any observed gender difference is reliable.) And when the difference between the sample averages is *large*, we have even more confidence that the difference between them reflects a real difference in their populations.

In short, when sample averages are reliable, and when the difference between them is relatively large, we say the difference has **statistical significance**. This means that the observed difference is probably not due to chance variation between the samples.

statistical significance a statistical statement of how likely it is that an obtained result occurred by chance.

In judging statistical significance, psychologists are conservative. They are like juries who must presume innocence until guilt is proven. For most psychologists, proof beyond a reasonable doubt means not making much of a finding unless the odds of its occurring by chance, if no real effect exists, are less than 5 percent.

When reading about research, you should remember that, given large enough or homogeneous enough samples, a difference between them may be "statistically

significant" yet have little *practical* significance. In one controversial study of nearly 700,000 Facebook users, researchers exposed people to status updates with more or with less positive words. Given the supersized sample's "statistical power," the tweaking produced a "statistically significant" but trivial effect. For example, those who received fewer posts with positive words responded with 0.1 percent fewer positive words themselves—a "statistically significant" effect, though one too tiny to be meaningful in the real world (Morin, 2014). Comparisons of intelligence test scores among hundreds of thousands of first-born and later-born individuals indicate a highly significant tendency for first-born individuals to have higher average scores than their later-born siblings (Rohrer et al., 2015; Zajonc & Markus, 1975). But because the scores differ by only one to three points, this "significant" difference has little practical importance.

The point to remember: Statistical significance indicates the *likelihood* that a result could have happened by chance. But this does not say anything about the *importance* of the result.

RETRIEVAL PRACTICE

RP-17 Can you solve this puzzle?

The registrar's office at the University of Michigan has found that usually about 100 students in Arts and Sciences have perfect marks at the end of their first term at the University. However, only about 10 to 15 students graduate with perfect marks. What do you think is the most likely explanation for the fact that there are more perfect marks after one term than at graduation (Jepson et al., 1983)?

RP-18 _____ statistics summarize data, while _____ statistics determine if data can be generalized to other populations.

For a review, engage online with **Concept Practice: Statistical Significance**.

RETRIEVAL PRACTICE ANSWERS

RP-17 Averages based on fewer courses are more variable, which guarantees a greater number of extremely low and high marks at the end of the first term. **RP-18** Descriptive; inferential

REVIEW Statistical Reasoning in Everyday Life

LEARNING OBJECTIVES

Test yourself by taking a moment to answer each of these Learning Objective Questions (repeated here from within this section). Then check your answer—a click away in the e-book, and in Appendix C of the printed text. Research suggests that trying to answer these questions on your own will improve your long-term retention (McDaniel et al., 2009, 2015).

LOQ 1-11 **How do we describe data using three measures of central tendency, and what is the relative usefulness of the two measures of variation?**

LOQ 1-12 **How do we know whether an observed difference can be generalized to other populations?**

TERMS AND CONCEPTS TO REMEMBER

Test yourself on these terms by trying to compose the definition before checking your answers.

mode, p. 45

mean, p. 45

median, p. 45

range, p. 45

standard deviation, p. 45

normal curve, p. 45

statistical significance, p. 46

MASTER THE MATERIAL

Test yourself repeatedly throughout your studies. This will not only help you figure out what you know and don't know; the testing itself will help you learn and remember the information more effectively thanks to the *testing effect*.

1. Which of the three measures of central tendency is most easily distorted by a few very large or very small scores?
   - **a.** The mode
   - **b.** The mean
   - **c.** The median
   - **d.** They are all equally vulnerable to distortion from atypical scores.
2. The standard deviation is the most useful measure of variation in a set of data because it tells us
   - **a.** the difference between the highest and lowest scores in the set.
   - **b.** the extent to which the sample being used deviates from the bigger population it represents.
   - **c.** how much individual scores differ from the mode.
   - **d.** how much individual scores differ from the mean.
3. Another name for a bell-shaped distribution, in which most scores fall near the middle and fewer scores fall at each extreme, is a _____ _____.
4. When sample averages are _____ and the difference between them is _____, we can say the difference has statistical significance.
   - **a.** reliable; large
   - **b.** reliable; small
   - **c.** due to chance; large
   - **d.** due to chance; small

Answers are a click away in the e-book, and available in Appendix D at the back of the printed text.

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