Thinking Critically With Psychological Science

Hoping to satisfy their curiosity about people and to remedy their own woes, millions turn to "psychology." They listen to talk-radio counseling. They read articles on psychic powers. They attend stop-smoking hypnosis seminars. They immerse themselves in self-help websites and books on the meaning of dreams, the path to ecstatic love, and the roots of personal happiness.

Others, intrigued by claims of psychological truth, wonder:
Do mothers and infants bond in the first hours after birth?
How—and how much—does parenting shape children's personalities and abilities?
What factors affect our drive to achieve?
Does psychotherapy heal?

In working with such questions, how can we separate uninformed opinions from examined conclusions? How can we best use psychology to understand why people think, feel, and act as they do?
What Is Psychology?

For people whose exposure to psychology comes from popular books, magazines, TV, and the Internet, psychologists seem to analyze personality, offer counseling, and dispense child-rearing advice. Do they? Yes, and much more. Consider some of psychology’s questions, which perhaps have also been yours:

- 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 person-to-person personality differences? To what extent do home and community environments shape us?

- Have you ever worried about how to act among people of a different culture, race, gender, 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, with a wave of relief, wondered why you had such a crazy dream? How often, and why, do we dream?

- Have you ever played peekaboo with a 6-month-old and wondered why the baby finds the game so delightful? The infant reacts as though, when you momentarily move behind a door, you actually disappear—only to reappear out of thin air. What do babies actually perceive and think?

- Have you ever wondered what fosters school and work success? Are some people just born smarter? And does sheer intelligence explain why some people get richer, think more creatively, or relate more sensitively?

- Have you ever wondered how the Internet, video games, and electronic social networks affect people? How do today’s electronic media influence how we think and how we relate?

- 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 for which someone should seek help?

Psychology is a science that seeks to answer such questions.

Psychology’s Roots

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 the source of our personality is the heart. But credit Aristotle with asking the right questions.

Psychological Science Is Born

Philosophers’ thinking about thinking continued until the birth of psychology 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 the time lag between people’s hearing a ball hit a platform and their pressing a telegraph key (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 by psychology’s first graduate students.

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. As physicists and chemists discerned the structure of matter, so Wundt’s student 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, 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. 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 contributed to our ancestors’ survival. Consciousness serves a function. It enables us to consider our past, adjust to our present, and plan our future. As a functionalist, James encouraged explorations of down-to-earth emotions, memories, willpower, habits, and moment-to-moment streams of consciousness.

As these names illustrate, the early pioneers of most fields, including psychology, were predominantly men. In 1890, over the objections of Harvard’s president, James admitted Mary Whiton Calkins into his graduate seminar (Scarborough & Furumoto, 1987). (In those years women lacked even the right to vote.) 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 the American Psychological Association’s (APA’s) first female president in 1905.

The honor of being the first female psychology Ph.D. later fell to Margaret Floy Washburn, who also wrote an influential book, The Animal Mind, and became the APA’s second female president in 1921.

William James and Mary Whiton Calkins: 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.

Margaret Floy Washburn: The first woman to receive a psychology Ph.D., Washburn synthesized animal behavior research in The Animal Mind.
Psychological Science Develops

In the field'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 engaged in introspective examination of the stream of consciousness and emotion. For these and other early pioneers, psychology was defined as "the science of mental life."

And so it continued 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." You cannot observe a sensation, a feeling, or a thought, they said, but you can observe and record people's behavior as they respond to different situations. Many agreed, and the behaviorists became one of psychology's two major forces well into the 1960s.

The other major force was Freudian psychology, which emphasized the ways our unconscious thought processes and our emotional responses to childhood experiences affect our behavior. (In chapters to come, we'll look more closely at Sigmund Freud's ideas.)

As the behaviorists had rejected the early 1900s definition of psychology, two other groups rejected the behaviorist definition in the 1960s. The first, the humanistic psychologists, led by Carl Rogers and Abraham Maslow, found both Freudian psychology and behaviorism too limiting. Rather than focusing on the meaning of early childhood memories or on the learning of conditioned responses, the humanistic psychologists drew attention to ways that current environmental influences can nurture or limit our growth potential, and the importance of having our needs for love and acceptance satisfied. (More on this in Chapter 12.)

The second group of psychologists pioneered the 1960s cognitive revolution, leading the field back to its early interest in mental processes. Cognitive psychology scientifically explores how we perceive, process, and remember information, and even why we can get anxious or depressed. Cognitive neuroscience, an interdisciplinary study, has enriched our understanding of the brain activity underlying mental activity.

To encompass psychology's concern with observable behavior and with inner thoughts and feelings, today we 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.
The key word in psychology’s definition is science. Psychology is less a set of findings than a way of asking and answering questions. My 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 describing and explaining the events of our lives.

Contemporary Psychology

This young science of psychology developed from the more established fields of philosophy and biology. Wundt was both a philosopher and a physiologist. Ivan Pavlov, who pioneered the study of learning (Chapter 7), was a Russian physiologist. Freud was an Austrian physician. Jean Piaget, the last century’s most influential observer of children, (Chapter 4), was a Swiss biologist. James was an American philosopher. This list of pioneering psychologists—“Magellans of the mind,” as Morton Hunt (1993) has called them—illustrates psychology’s origins in many disciplines and countries.

Like the pioneers, today’s psychologists are citizens of many lands. The International Union of Psychological Science has 71 member nations, from Albania to Zimbabwe. Psychology is growing and it is globalization. The story of psychology is being written in many places, with interests ranging from nerve cell activity to international conflicts.

Psychology’s Biggest Question

1-2: What is psychology’s historic big issue?

Are our human traits present at birth, or do they develop through experience? The debate over this huge 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.

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

humanistic psychology historically significant perspective that emphasized the growth potential of healthy people.

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 psychological science sees traits and behaviors arising from the interaction of nature and nurture.
More insight into nature's influence on behavior arose after a 22-year-old seafaring voyager, Charles Darwin, pondered the incredible species variation he encountered, including tortoises on one island that differed from those on nearby islands. His 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 is still with us 150+ years later as biology's organizing principle, and now an important principle for twenty-first-century psychology. This would surely have pleased Darwin, for he 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).

The nature–nurture issue recurs throughout this text as today's psychologists explore the relative contributions of biology and experience, asking, for example, how we humans are alike (because of our common biology and evolutionary history) and diverse (because of our differing environments). 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?

Over and over again we will see that in contemporary science the nature–nurture tension dissolves: *Nurture works on what nature endows*. 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.

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**RETRIEVE IT**

- What is contemporary psychology's position on the nature–nurture debate?

**ANSWER:** Biological and psychological events often stem from the interaction of nature and nurture. Under these events, their

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**Psychology's Three Main Levels of Analysis**

1. **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 why grizzly bears hibernate. Is it because hibernation helped their ancestors to survive and reproduce? Because their inner physiology drives them to do so? Because cold environments hinder food gathering during winter? Such perspectives are complementary because "everything is related to everything else" (Brewer, 1996). Together, different levels of analysis form a biopsychosocial approach, which integrates biological, psychological, and social-cultural factors (FIGURE 1.1).
Each level provides a vantage point for viewing a behavior or mental process, yet each by itself is incomplete. Like different academic disciplines, psychology's varied perspectives ask different questions and have their own limits. The different perspectives described in Table 1.1 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 the evolutionary perspective might analyze how anger facilitated the survival of our ancestors' genes.
- Someone working from the behavior genetics perspective might study how heredity and experience influence our individual differences in temperament.
- Someone working from the psychodynamic perspective might view an outburst as an outlet for unconscious hostility.

### Table 1.1
Psychology's Current Perspectives

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Focus</th>
<th>Sample Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroscience</td>
<td>How the body and brain enable emotions, memories, and sensory experiences</td>
<td>How do pain messages travel from the hand to the brain? How is blood chemistry linked with moods and motives?</td>
</tr>
<tr>
<td>Evolutionary</td>
<td>How the natural selection of traits has promoted the survival of genes</td>
<td>How does evolution influence behavior tendencies?</td>
</tr>
<tr>
<td>Behavior genetics</td>
<td>How our genes and our environment influence our individual differences</td>
<td>To what extent are psychological traits such as intelligence, personality, sexual orientation, and vulnerability to depression products of our genes? Of our environment?</td>
</tr>
<tr>
<td>Psychodynamic</td>
<td>How behavior springs from unconscious drives and conflicts</td>
<td>How can someone's personality traits and disorders be explained by unfulfilled wishes and childhood traumas?</td>
</tr>
<tr>
<td>Behavioral</td>
<td>How we learn observable responses</td>
<td>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?</td>
</tr>
<tr>
<td>Cognitive</td>
<td>How we encode, process, store, and retrieve information</td>
<td>How do we use information in remembering? Reasoning? Solving problems?</td>
</tr>
<tr>
<td>Social-cultural</td>
<td>How behavior and thinking vary across situations and cultures</td>
<td>How are we alike as members of one human family? How do we differ as products of our environment?</td>
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</tbody>
</table>
Someone working from the behavioral perspective might attempt to determine which external stimuli trigger angry responses or aggressive acts.

Someone working from the cognitive perspective might study how our interpretation of a situation affects our anger and how our anger affects our thinking.

Someone working from the 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.

Psychology's Subfields

1-4: What are psychology’s main subfields?

Picturing a chemist at work, you probably envision a white-coated scientist surrounded by glassware 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.
- someone at a computer analyzing data on whether adopted teens’ temperaments more closely resemble those of their adoptive parents or their biological parents.
- a therapist listening carefully to a client’s depressed thoughts.
- a traveler visiting another culture and collecting data on variations in human values and behaviors.
- a teacher or writer sharing the joy of psychology with others.

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.
The cluster of subfields we call psychology is a meeting ground for different disciplines. Thus, it’s a perfect home for those with wide-ranging interests. In its diverse activities, from biological experimentation to cultural comparisons, 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. In the pages that follow you will meet a wide variety of such researchers, including biological psychologists exploring the links between brain and mind; developmental psychologists studying 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.

Although most psychology textbooks focus on psychological science, psychology is also a helping profession devoted to such practical issues as how to have a happy marriage, how to overcome anxiety or depression, and how to raise thriving children. As a science, psychology at its best bases such interventions on evidence of effectiveness. Counseling psychologists help people to cope with challenges and crises (including academic, vocational, and marital issues) and to improve their personal and social functioning. Clinical psychologists assess and treat 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.

To balance psychology’s focus on human problems, Martin Seligman and others (2002, 2005, 2011) have called for research on human strengths and human flourishing. Their positive psychology scientifically explores “positive emotions, positive character traits, and enabling institutions.” What, they ask, can psychology contribute to a “good life” that engages one’s skills, and to a “meaningful life” that points beyond oneself?

With perspectives ranging from the biological to the social, and with settings from the laboratory to the clinic, psychology relates to many fields. Psychologists teach not only in psychology departments, but also in medical schools, law schools, and theological seminaries, and they work in hospitals, factories, and corporate offices. They engage in interdisciplinary studies, such as psychobiology (the psychological analysis of historical characters), psycholinguistics (the study of language and thinking), and psychoceramics (the study of crackpots).

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1 Confession: I wrote the last part of this sentence on April Fools’ Day.

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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 relationships) 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 sometimes provide medical (for example, drug) treatments as well as psychological therapy.

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

Want to learn more? See Appendix C, Subfields of Psychology, at the end of this book, and go to the regularly updated Careers in Psychology at www.yourpsycportal.com/myers to learn about the many interesting options available to those with bachelor’s, master’s, and doctoral degrees in psychology.

Psychology: A science and a profession. Psychologists experiment with, observe, test, and treat behavior. Here we see psychologists testing a child, measuring emotion-related physiology, and doing face-to-face therapy.
Psychology also influences culture. And psychology deepens our appreciation for how we humans perceive, think, feel, and act. By so doing it can indeed enrich our lives and enlarge our vision. Through this book I 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.”

**RETRIEVE IT**

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

2. Psychiatry b. Studies, assesses, and treats people with psychological disorders; but usually does not provide medical therapy.

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**The Need for Psychological Science**

Although in some ways we outsmart the smartest computers, our intuition often goes awry. To err is human. Enter psychological science. With its procedures for gathering and sifting evidence, science restrains error. As we familiarize ourselves with its strategies and incorporate its underlying principles into our daily thinking, we can think smarter. **Psychologists use the science of behavior and mental processes to better understand why people think, feel, and act as they do.**

**What About Intuition and Common Sense?**

1-5: How do hindsight bias, overconfidence, and the tendency to perceive order in random events illustrate why science-based answers are more valid than those based on intuition and common sense?

Some people suppose that psychology merely documents and dresses in jargon what people already know: “So what else is new—you get paid for using fancy methods to prove what my grandmother knew?” Others place their faith in human intuition. Former President George W. Bush described the feeling to journalist Bob Woodward (2002) in explaining his decision to launch the Iraq war: “I’m a gut player. I rely on my instincts.” Today’s psychological science does document a vast intuitive mind. As we will see, our thinking, memory, and attitudes operate on two levels—conscious and unconscious—with the larger part operating off-screen, automatically. Like jumbo jets, we fly mostly on autopilot.

So, are we smart to listen to the whispers of our inner wisdom, to simply trust “the force within”? Or should we more often be subjecting our intuitive hunches to skeptical scrutiny?

This much seems certain: We often underestimate intuition’s perils. My geographical intuition tells me that Reno is east of Los Angeles, that Rome is south of New York, that Atlanta is east of Detroit. But I am wrong, wrong, and wrong. As novelist Madeleine L’Engle observed, “The naked intellect is an extraordinarily inaccurate instrument” (1973). Three phenomena—hindsight bias, judgmental overconfidence, and our tendency to perceive patterns in random events—illustrate why we cannot rely solely on intuition and common sense.

“The limits of intuition Personnel interviewers tend to be overconfident of their gut feelings about job applicants. Their confidence stems partly from their recalling cases where their favorable impression proved right, and partly from their ignorance about rejected applicants who succeeded elsewhere.”

"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 football game, we credit the coach if a “gutsy play” wins the game, and fault the coach for the “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.”

This **hindsight bias** (also known as the I-knew-it-all-along phenomenon) is easy to demonstrate: Give half the members of a group some purported psychological finding, and give the other half an opposite result. Tell the first group, “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 nearly all will then view this true finding as unsurprising.

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 two opposite findings both seem like common sense, there is a problem.

Such errors in our recollections and explanations show why we need psychological research. Just asking people how and why they felt or acted as they did can sometimes be misleading—not because common sense is usually wrong, but because common sense more easily describes what has happened than what will happen.

Nevertheless, Grandma’s intuition is often right. As Yogi Berra once said, “You can observe a lot by watching.” (We have Berra to thank for other gems, such as “Nobody ever comes here—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, and they are right (we have what Chapter 10 calls a deep “need to belong”). Indeed, as Daniel Gilbert, Brett Pelham, and Douglas Krull (2003) have noted, “good ideas in psychology usually have an oddly familiar quality, and the moment we encounter them we feel certain that we once came close to thinking the same thing ourselves and simply failed to write it down.” Good ideas are like good inventions; once created, they seem obvious. (Why did it take so long for someone to invent suitcases on wheels and Post-it Notes?)

**Hindsight bias** When drilling the Deepwater Horizon oil well in 2010, BP employees took some shortcuts and ignored some warning signs, without intending to put their company and the environment at serious risk. After the resulting Gulf oil spill, with the benefit of 20/20 hindsight, the foolishness of those judgments became obvious.

“Life is lived forwards, but understood backwards.”

*Philosopher Søren Kierkegaard. 1813-1855*

“Anything seems commonplace, once explained.”

*Dr. Watson to Sherlock Holmes*
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

But sometimes Grandma's intuition, informed by countless casual observations, has it 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.

**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.² Or consider these three anagrams, which Richard Goranson (1978) asked people to unscramble:

- WREAT → WATER
- ETRYN → ENTRY
- GRABE → BARGE

About how many seconds do you think it would have taken you to unscramble each of these? 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.³

Are we any better at predicting social behavior? Ohio State University 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."

**Perceiving Order in Random Events**

In our natural eagerness to make sense of our world—what poet Wallace Stevens called our "rage for order"—we are prone to perceive patterns. People see a face on the moon, hear Satanic messages in music, or perceive the Virgin Mary's image on a grilled cheese sandwich. Even in random data we often find order, because—here's a curious fact of life—random sequences often don't look random (Falk et al., 2009; Nickerson, 2002, 2005).

In actual random sequences, patterns and streaks (such as repeating digits) occur more often than people expect (Oskarsson et al., 2009). To demonstrate this phenomenon for myself, I flipped a coin 51 times, with these results:


² Boston is south of Paris.
³ The anagram solution: CHAOS.
Looking over the sequence, patterns jump out: Tosses 10 to 22 provided an almost perfect pattern of pairs of tails followed by pairs of heads. On tosses 30 to 38 I had a “cold hand,” with only one head in nine tosses. But my fortunes immediately reversed with a “hot hand”—seven heads out of the next nine tosses. Similar streaks happen—about as often as one would expect in random sequences—in basketball shooting, baseball hitting, and mutual fund stock pickers’ selections (Gilovich et al., 1985; Malkiel, 2007; Myers, 2002). These sequences often don’t look random and so are overinterpreted. (“When you’re hot, you’re hot!”)

What explains these streaky patterns? Was I exercising some sort of paranormal control over my coin? Did I snap out of my tails funk and get in a heads groove? No such explanations are needed, for these are the sorts of streaks found in any random data. Comparing each toss to the next, 23 of the 50 comparisons yielded a changed result—just the sort of near 50-50 result we expect from coin tossing. Despite seeming patterns, the outcome of one toss gives no clue to the outcome of the next.

However, some happenings seem so extraordinary that we struggle to conceive an ordinary, chance-related explanation. In such cases, statisticians often are less mystified. When Evelyn Marie Adams won the New Jersey lottery twice, newspapers reported the odds of her feat as 1 in 17 trillion. Bizarre? Actually, 1 in 17 trillion are indeed the odds that a given person who buys a single ticket for each of two New Jersey lotteries will win both times. And given the millions of people who buy U.S. state lottery tickets, statisticians Stephen Samuels and George McCabe (1989) reported, it was “practically a sure thing” that someday, somewhere, someone would hit a state jackpot twice. Indeed, said fellow statisticians Persi Diaconis and Frederick Mosteller (1989), “with a large enough sample, any outrageous thing is likely to happen.” An event that happens to but 1 in 1 billion people every day occurs about 7 times a day, over 2500 times a year.

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

The Scientific Attitude: Curious, Skeptical, and Humble

1-6: How do the scientific attitude’s three main components relate to critical thinking?

Underlying all science is, first, a hard-headed curiosity, 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 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 told me that no aura seer has agreed to take this simple test.

No matter how sensible-seeming or 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.

More often, science becomes society’s garbage disposal, 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, sense from nonsense, therefore requires a scientific attitude: being skeptical but not cynical, open but not gullible.

“To believe with certainty,” says a Polish proverb, “we must begin by doubting.” As scientists, psychologists approach the world of behavior with a curious skepticism, persistently asking two questions: What do you mean? How do you know?

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 surprises and new perspectives. In the last analysis, what matters is not my opinion or yours, but the truths nature reveals in response to our questioning. 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.”

Historians of science tell us that these three attitudes—curiosity, skepticism, and humility—helped make modern science possible. Some deeply religious people today may view science, including psychological science, 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).

Of course, scientists, like anyone else, can have big egos and may cling to their preconceptions. Nevertheless, the ideal of curious, skeptical, humble scrutiny of competing ideas unifies psychologists as a community as they check and recheck one another’s findings and conclusions.

Non Sequitur
Critical Thinking

The scientific attitude prepares us to think smarter. Smart thinking, called critical thinking, examines assumptions, discerns hidden values, evaluates evidence, and assesses conclusions. Whether reading a news report or listening to a conversation, critical thinkers ask questions. Like scientists, they wonder, How do they know that? What is this person’s agenda? Is the conclusion based on anecdote and gut feelings, or on evidence? Does the evidence justify a cause-effect conclusion? What alternative explanations are possible?

Has psychology’s critical inquiry been open to surprising findings? The answer, as ensuing chapters illustrate, is plainly Yes. Believe it or not, massive losses of brain tissue early in life may have minimal long-term effects (see Chapter 2). Within days, newborns can recognize their mother’s odor and voice (see Chapter 4). 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 disabilities and without—report roughly comparable levels of personal happiness (see Chapter 11).

And has critical inquiry convincingly debunked popular presumptions? The answer, as ensuing chapters also illustrate, is again Yes. The evidence indicates that 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 “hit the replay button” 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 12). Opposites do not generally attract (see Chapter 13). In each of these instances and more, what psychological science has learned is not what is widely believed.

"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

How Do Psychologists Ask and Answer Questions?

Psychologists arm their scientific attitude with the scientific method—a self-correcting process for evaluating ideas with observation and analysis. In its attempt to describe and explain human nature, 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 the predictions fail, the theory will be revised or rejected.

The Scientific Method

1-7: How do theories advance psychological science?

In everyday conversation, we often use theory to mean “mere hunch.” In science, a theory explains with principles that organize observations and predict behaviors or events. By organizing isolated facts, a theory simplifies. By linking facts with deeper principles, a theory offers a useful summary. As we connect the observed dots, a coherent picture emerges.

critical thinking: thinking that does not blindly accept arguments and conclusions. Rather, it examines assumptions, discerns hidden values, evaluates evidence, and assesses conclusions.

theory: an explanation using an integrated set of principles that organizes observations and predicts behaviors or events.
A good theory about sleep deprivation's effects on 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 accurately in class, and they do well at test time. We might therefore theorize that sleep improves memory. So far so good: Our sleep-retention principle neatly summarizes a list of facts about the effects of sleep loss.

Yet no matter how reasonable a theory may sound—and it does seem reasonable to suggest that sleep loss could affect memory—we must put it to the test. A good theory produces testable predictions, called hypotheses. By enabling us to test and to reject or revise our theory, such predictions direct research. They specify what results would support the theory and what results would disconfirm it. To test our theory about the effects of sleep on memory, we might assess people's retention of course materials after a good night's sleep, or a shortened night's sleep (FIGURE 1.2).

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 insightful. 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.

As a check on their biases, psychologists report their research with precise operational definitions of procedures and concepts. Hunger, for example, might be defined as "hours without eating," generosity as "money contributed," sleep loss as "hours less" than one'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 aroused psychologists’ curiosity. Now, after many successful replications with different people and questions, we feel sure of the phenomenon’s power.

In the end, our theory will be useful if it (1) organizes a range of self-reports and 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 lead to a revised theory that better organizes and predicts what we know. Or, our research may be replicated and supported by similar findings. (This has been the case for sleep and memory studies, as you will see in Chapter 3.)

As we will see next, we can test our hypotheses and refine our theories using descriptive methods (which describe behaviors, often through case studies, naturalistic
observations, or surveys), *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.

**RETRIEVE IT**

- What does a good theory do?
  - *Predicts applications.*
  - *Implies hypotheses that differ from existing predictions and sometimes conflict.*
- Why is replication important?
  - *Psychologists watch eagerly for new findings, but they also proceed with caution—by awaiting other investigations regarding the research. In the findings by controlled (the usual replication)?

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### Description

**1-8: 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 act as they do. Professional psychologists do much the same, though more objectively and systematically, through

- **case studies** (in-depth analyses of special individuals).
- **naturalistic observation** (watching and recording individuals' behavior in their natural setting).
- **surveys** and interviews (self-reports in which people answer questions about their behavior or attitudes).

### The Case Study

Among the oldest research methods, the **case study** examines one individual in depth in the hope of revealing things true of us all. Some examples: Much of our early knowledge about the brain came from case studies of individuals who suffered a particular impairment after damage to a certain brain region. Jean Piaget taught us about children's thinking after carefully observing and questioning only a few children. Studies of only a few chimpanzees revealed their capacity for understanding and language. Intensive case studies are sometimes very revealing. They show us what can happen, and they often suggest directions for further study.

But individual cases may mislead us if the individual is atypical. Unrepresentative information can lead to mistaken 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 so begin an article about bank foreclosures with the sad story of one family put out of their house, not with foreclosure statistics. 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. As psychologist Gordon Allport (1954, p. 9) said,“Given a thimbleful of [dramatic] facts we rush to make generalizations as large as a tub.”

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"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, 1935*

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*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 12 will explain, today's psychological science discounts Freud's theory of childhood sexuality but acknowledges that much of the human mind operates outside our conscious awareness.  
*Skye Hohmann/Alamy*
**naturalistic observation** observing and recording behavior in naturally occurring situations without trying to manipulate and control the situation.

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

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. But to discern the general truths that cover individual cases, we must answer questions with other research methods.

**Naturalistic Observation**

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

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. 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. “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). Thanks to researchers’ observations, we know that chimpanzees and baboons use deception. Psychologists Andrew Whiten and Richard Byrne (1988) 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. The more developed a primate species’ brain, the more likely it is that the animals will display deceptive behaviors (Byrne & Corp, 2004).

A natural observer. Chimpanzee researcher Frans de Waal (2005) reported, “I am a born observer…. When picking a seat in a restaurant I want to face as many tables as possible. I enjoy following the social dynamics—love, tension, boredom, antipathy—around me based on body language, which I consider more informative than the spoken word. Since keeping track of others is something I do automatically, becoming a fly on the wall of an ape colony came naturally to me.”

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

1. **A funny finding.** We humans laugh 30 times more often in social situations than in solitary situations. (Have you noticed how seldom you laugh when alone?) As we laugh, 17 muscles contort our mouth and squeeze our eyes, and we emit a series of 75-millisecond vowel-like sounds, spaced about one-fifth of a second apart (Provine, 2001).
**Sounding out students.** What, really, are introductory psychology students saying and doing during their everyday lives? To find out, Matthias Mehl and James Pennebaker (2003) equipped 52 such students from the University of Texas with belt-worn Electronically Activated Recorders (EARS). For up to four days, the EAR captured 30 seconds of the student’s waking hours every 12.5 minutes, thus enabling the researchers to eavesdrop on more than 10,000 half-minute life slices by the end of the study. On what percentage of the slices do you suppose they found the students talking with someone? What percentage captured the students at a computer keyboard? The answers: 28 and 9 percent. (What percentage of your waking hours are spent in these activities?)

**Culture, climate, and the pace of life.** Naturalistic observation also enabled Robert Levine and Ara Norenzayan (1999) to compare the pace of life in 31 countries. (Their operational definition of pace of life included walking speed, the speed with which postal clerks completed a simple request, and the accuracy of public clocks.) Their conclusion: Life is fastest paced in Japan and Western Europe and slower paced in economically less-developed countries. **People** in colder climates also tend to live at a faster pace (and are more prone to die from heart disease).

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.

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**The Survey**

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

- half of all Americans reported experiencing more happiness and enjoyment than worry and stress on the previous day (Gallup, 2010).
- 1 in 5 people across 22 countries reported believing that alien beings have come to Earth and now walk among us disguised as humans (Ipsos, 2010b).
- 68 percent of all humans—some 4.6 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 question wording and respondent selection.

**Wording Effects** Even subtle changes in the order or wording of questions can have major effects. People are much more approving of “aid to the needy” than of “welfare,” of “affirmative action” than of “preferential treatment,” of “not allowing” televised cigarette ads and pornography than of “censoring” them, and of “revenue enhancers” than of “taxes.” In 2009, three in four Americans in one national survey approved of giving people “a choice” of public (government-run) or private health insurance. Yet in another survey, most Americans were not in favor of “creating a public health care plan administered by the federal government that would compete directly with private health insurance companies” (Stein, 2009). 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 cases we observe, especially vivid cases. Given (a) a statistical summary of a professor’s student evaluations and (b) the vivid comments of a biased sample—two irate students—an administrator’s impression of the professor may be influenced as much by the two unhappy students as by the many favorable evaluations in the statistical summary. The temptation to ignore the sampling bias and to generalize from a few vivid but unrepresentative cases is nearly irresistible.

So how do you obtain a representative sample—say, of the students at your college or university? It’s not always possible to survey the whole group you want to study and describe. How could you choose a group that would represent the total student population? Typically, you would seek a random sample, in which every person in the entire group has an equal chance of participating. 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 small representative sample of 100 is better than an unrepresentative sample of 500.

Political pollsters sample voters in national election surveys just this way. Using only 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 call-in phone samples and TV or website polls—often merely 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.

Correlation

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

A positive correlation (between 0 and +1.00) indicates a direct relationship, meaning that two things increase together or decrease together.

A negative correlation (between 0 and −1.00) indicates an inverse relationship: As one thing increases, the other decreases. The weekly number of hours spent in TV watching and video gaming correlates negatively with grades. Negative correlations could go as low as −1.00, which means that, like people on the opposite ends of a teeter-totter, one set of scores goes down precisely as the other goes up.

Though informative, psychology’s correlations usually leave most of the variation among individuals unpredicted. As we will see, there is a positive correlation between parents’ abusiveness and their children’s later abusiveness when they become parents. But
this does not mean that most abused children become abusive. The correlation simply indicates a statistical relationship: Most abused children do not grow into abusers, but nonabused children are even less likely to become abusive. Correlations point us toward predictions, but usually imperfect ones.

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

Correlation and Causation

Correlations help us predict. The New York Times reports that U.S. counties with high gun ownership rates tend to have high murder rates (Luo, 2011). Gun ownership predicts homicide. What might explain this guns-homicide correlation?

I can almost hear someone thinking, “Well, of course, guns kill people, often in moments of passion.” If so, that could be an example of A (guns) causes B (murder). But I can hear other readers saying, “Not so fast. Maybe people in dangerous places buy more guns for self-protection—maybe B causes A.” Or maybe some third factor C causes both A and B.

Another example: Self-esteem correlates negatively with (and therefore predicts) depression. (The lower people’s self-esteem, the more they are at risk for depression.) So, does low self-esteem cause depression? If, based on the correlational evidence, you assume that it does, you have much company. A nearly irresistible thinking error is assuming that an association, sometimes presented as a correlation coefficient, proves causation. But no matter how strong the relationship, it does not.

As options 2 and 3 in FIGURE 1.3 on the next page show, we’d get the same negative correlation between self-esteem and depression if depression caused people to be down on themselves, or if some third factor—such as heredity or distressing events—caused both low self-esteem and depression.

This point is so important—so basic to thinking smarter with psychology—that it merits one more example. 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 (Resnick et al., 1997). “Adults have a powerful effect on their children’s
FIGURE 1.3
Three possible cause-effect relationships. People low in self-esteem are more likely to report depression than are those high in self-esteem. One possible explanation of this negative correlation is that a bad self-image causes depressed feelings. But, as the diagram indicates, other cause-effect relationships are possible.

A New York Times writer reported a massive survey showing that “adolescents whose parents smoked were 50 percent more likely than children of nonsmokers to report having had sex.” He concluded (would you agree?) that the survey indicated a causal effect—that “to reduce the chances that their children will become sexually active at an early age” parents might “quit smoking” (O’Neil, 2002).

A New York Times writer reported a massive survey showing that “adolescents whose parents smoked were 50 percent more likely than children of nonsmokers to report having had sex.” He concluded (would you agree?) that the survey indicated a causal effect—that “to reduce the chances that their children will become sexually active at an early age” parents might “quit smoking” (O’Neil, 2002).

behavior right through the high school years,” gushed an Associated Press (AP) story reporting the finding. But this correlation comes with no built-in cause-effect arrow. The AP could as well have reported, “Well-behaved teens feel their parents’ love and approval; out-of-bounds teens more often think their parents are disapproving.”

The point to remember (turn the volume up here): Association does not prove causation. Correlation indicates the possibility of a cause-effect relationship but does not prove such. Remember this principle and you will be wiser as you read and hear news of scientific studies.

Experimentation

1-10: 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 perceive causes in correlational studies, such as the correlation between breast feeding and intelligence?

Researchers have found that the intelligence scores of children who were breast-fed as infants are somewhat higher than the scores of children who were bottle-fed with cow’s milk (Angelsen et al., 2001; Mortensen et al., 2002; Quina et al., 2001). In Britain, breast-fed babies have also been more likely than their bottle-fed counterparts to eventually move into a higher social class (Martin et al., 2007). But the “breast is best” intelligence effect shrinks when researchers compare breast-fed and bottle-fed children from the same families (Der et al., 2006).

What do such findings mean? Do smarter mothers (who in modern countries more often breast feed) have smarter children? Or, as some researchers believe, do the nutrients of mother’s milk contribute to brain development? To find answers to such questions—to isolate cause and effect—researchers can 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 whose members do not receive the treatment. To minimize any preexisting differences between the two groups, researchers randomly assign people to the two conditions. 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...
wiggles. So, too, with ages, 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.

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

No single experiment is conclusive, of course. But randomly assigning participants to one feeding group or the other effectively eliminated all factors except nutrition. This supported the conclusion that breast is indeed best for developing intelligence: If a behavior (such as test performance) changes when we vary an experimental factor (such as infant nutrition), then we infer that the factor is having an effect.

The point to remember: Unlike correlational studies, which uncover naturally occurring relationships, an experiment manipulates a factor to determine its 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 vitamin C 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 investigators evaluate new drug treatments and new methods of psychological therapy (Chapter 15). They randomly assign participants either to the group receiving a treatment (such as a medication), or to a group receiving a 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 or placebo and collect the data will know which group is receiving the treatment.

In such studies, researchers can 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). And the more expensive the placebo, the more "real" it seems to us—a fake pill that costs $2.50 works 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.

**Retrieve It**

• What measure 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 dysfunction to either an experimental group (Viagra takers) or a control group (placebo takers). It was a double-blind procedure—neither the men nor the person giving them the pills 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 worked.
FIGURE 1.4
Experimentation To discern causation, psychologists may randomly assign some participants to an experimental group, others to a control group. Measuring the dependent variable (intelligence score in later childhood) will determine the effect of the independent variable (whether breast milk was promoted).

This simple experiment manipulated just one factor: the drug dosage (none versus peak dose). 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. These other factors, which could influence the experiment’s results, are called confounding variables. Random assignment controls for possible confounding variables.

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 (in this study, the precise drug dosage and timing) or measure the dependent variable (the questions that assessed the men’s responses). These definitions answer the “What do you mean?” question with a level of precision that enables others to repeat the study. (See FIGURE 1.4 for the 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 identical 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 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 the apartment rental experiment, what was the independent variable? The dependent variable?

**Answer:** The independent variable, which the researchers manipulated, was the ethically-labeled names. The dependent variable was the percentage of positive replies.

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 anti-smoking campaigns? Do school sex-education programs reduce teen 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 confirmed (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). Experiments aim to manipulate an independent variable, measure the 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
Table 1.2
Comparing Research Methods

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

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). Table 1.2 compares the features of psychology's research methods.

Retrieve It

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

1. double-blind procedure a. helps researchers generalize from a small set of survey responses to a larger population
2. random sampling b. helps minimize preexisting differences between experimental and control groups
3. random assignment c. controls for the placebo effect; neither researchers nor participants know who receives the real treatment

**Answers:** 1.3 2.4 3.6

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

Frequently Asked Questions

About 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, which indicates how well one thing 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 frequently asked questions.
1-11: Can laboratory experiments 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 real life? For example, does detecting the blink of a faint red light in a dark room reveal anything useful about flying a plane at night? After viewing a violent, sexually explicit film, does an aroused man’s increased willingness to push buttons that he thinks will electrically shock a woman really say anything about whether 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 shock 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 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 have demonstrated 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 particular behaviors than on seeking general principles that help explain many behaviors.

1-12: Does behavior depend on one’s culture and gender?

What can we learn about people in general from psychological studies done in one time and place—often with people from what Joseph Henrich, Steven Heine, and Ara Norenzayan (2010) call the WEIRD cultures (Western, Educated, Industrialized, Rich, and Democratic cultures that contribute most study participants but are only 12 percent of humanity)? 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 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. Given the growing mixing and clashing of cultures, our need for such awareness is urgent.

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

- People diagnosed with dyslexia, a reading disorder, 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. 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 gender matters, too. Researchers report gender differences in what we dream, in how we express and detect emotions, and in our risk for alcohol dependence, depression, and eating disorders. Gender differences fascinate us, and studying them is potentially beneficial. For example, many researchers believe that women carry on conversations more readily to build relationships, while men talk more to give information and advice (Tannen, 2001). Knowing this difference can help us prevent conflicts and misunderstandings in everyday relationships.

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 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.

1-13: Why do psychologists study animals, and what ethical guidelines safeguard human and animal research participants?

Many psychologists study 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 more 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 respect rather than experiment on our animal relatives? The animal protection movement protests the use of animals in psychological, biological, and medical research.

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 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? Is our use and consumption of other animals as natural as the behavior of carnivorous hawks, cats, and whales? The answers to such questions vary by culture. In Gallup surveys in Canada and the United States, about 60 percent of adults have deemed medical testing on animals “morally acceptable.” In Britain, only 37 percent have (Mason, 2003).

If we give human life first priority, what safeguards should protect the well-being of animals in research? In one survey of animal researchers, 98 percent supported government regulations protecting primates, dogs, and cats, and 74 percent 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 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 ensure the “comfort, health, and humane treatment” of animals and minimize “infection, illness, and pain” (APA, 2002). The European Parliament now mandates standards for animal care and housing (Vogel, 2010).

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.

“All people are the same; only their habits differ.”
Confucius, 551-479 B.C.E.

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

“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)

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

Animal research benefiting animals

Thanks partly to research on the benefits of novelty, control, and stimulation, these gorillas have enjoyed an improved quality of life in New York’s Bronx Zoo.
What about human participants? Does the image of white-coated scientists delivering electric shocks trouble you? If so, you’ll be relieved to know that most psychological studies are free of such stress. With people, 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 by reality TV shows. 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 APA ethics code urges researchers to (1) obtain human participants' informed consent before the experiment, (2) protect them from harm and discomfort, (3) keep information about individual participants confidential, and (4) fully debrief people (explain the research afterward). Moreover, university ethics committees screen research proposals and safeguard participants' well-being.

**1-14: Is psychology free of value judgments?**

Psychology is definitely not value free. Values affect what we study, how we study it, and how we interpret results. Researchers' values influence their choice of topics. Should we study worker productivity or worker morale? Sex discrimination or gender differences? Conformity or independence? Values can also color “the facts.” As we noted earlier, our preconceptions can bias our observations and interpretations; sometimes we see what we want or expect to see (Figure 1.5).

Even the words we use to describe something can reflect our values. Are the acts we do not practice “perversions” or “sexual variations”? In psychology and in everyday speech, labels describe and labels evaluate: One person’s *rigidity* is another’s *consistency*. One person’s *faith* is another’s *fanaticism*. One country's *enhanced interrogation techniques*, such as cold-water immersions, become *torture* when practiced by its enemies. 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, what to do with 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.

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 rear 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 remember (and misremember) our experiences, how people across the world differ (and are alike)—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?"

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 too wonderful” for us yet to 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.

If some people see psychology as merely common sense, others have a different concern—that it is becoming dangerously powerful. Is it an accident that astronomy is the oldest science and psychology the youngest? To some, exploring the external universe seems far safer than exploring our own inner universe. Might psychology, they ask, 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 indeed have the power to deceive, its purpose is to enlighten. Every day, psychologists are exploring ways to enhance learning, creativity, and compassion. Psychology speaks to many of the 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.

**RETRIEVE IT**

How are human research participants protected?

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**ANSWER:** Ethical principles developed by international epistemological organizations require researchers using human subjects to obtain informed consent from their human test or experiment participants. In addition, human research participants are protected by federal laws that require researchers to obtain informed consent from human research participants. Informed consent gives potential participants enough information about a study to enable them to decide whether they wish to participate.

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

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

SQ3R a study method incorporating five steps: Survey, Question, Read, Retrieve, Review.

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**Improve Your Retention—and Your Grades**

1-15: How can psychological principles help you learn and remember?

Do you, like most students, assume that the way to cement your 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, 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).

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 is more like a muscle that grows stronger with exercise. 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.

The SQ3R study method incorporates these principles (McDaniel et al., 2009; Robinson, 1970). SQ3R is an acronym for its five steps: Survey, Question, Read, Retrieve, Review.

To study a chapter, first survey, taking a bird’s-eye view. Scan the headings, and notice how the chapter is organized. Before you read each main section, try to answer its numbered Learning Objective Question (for this section: “How can psychological principles help you learn and
remember?\). Roediger and Bridgid Finn (2009) 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?

Having read a section, retrieve its main ideas. Test yourself. This will help you figure out what you know. Moreover, the testing itself will help you learn and retain the information more effectively. Even better, test yourself repeatedly. To facilitate this, I offer periodic Retrieve It opportunities throughout each chapter (see, for example, the questions on pages 29 and 31). After trying to answer these questions yourself, you can check the inverted answers, 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. I have organized this book’s chapters to facilitate your use of the SQ3R study system. Each chapter begins with a chapter 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 Retrieve It questions will challenge you to retrieve what you have learned, and thus better remember it. The end-of-chapter Review provides more opportunities for active processing and self-testing, focusing on the chapter’s key terms and Learning Objective Questions. Complete Chapter Reviews can be found in Appendix D, at the end of this book.

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 does massed practice. You will remember material better if you space your practice time over several study periods—perhaps one hour a day, six days a week—rather than cram it into one long 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 will boost your long-term retention and will protect against overconfidence (Kornell & Bjork, 2008; Taylor & Rohrer, 2010).

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

**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?

**Process class information actively.** Listen for a lecture’s main ideas and sub-ideas. **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. Take notes in your own words. Relate what you read to what you already know. Tell someone else about it. (As any teacher will confirm, to teach is to remember.)

**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. Using the Retrieve It opportunities, devote extra study time to testing your knowledge.

Memory experts Elizabeth Bjork and Robert Bjork (2011, p. 63) 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.

RETRIEVE IT

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

ANSWER: Testing effect

• What does the acronym SQ3R stand for?

ANSWER: Survey, Question, Read, Retrieve, and Review

CHAPTER REVIEW

Thinking Critically With Psychological Science

LEARNING OBJECTIVES

Test Yourself by taking a moment to answer each of these Learning Objective Questions (repeated here from within the chapter). Then turn to Appendix D, Complete Chapter Reviews, to check your answers. Research suggests that trying to answer these questions on your own will improve your long-term memory of the concepts (McDaniel et al., 2009).

What is Psychology?
1-1: What are some important milestones in psychology's development?

Contemporary Psychology
1-2: What is psychology’s historic big issue?
1-3: What are psychology’s levels of analysis and related perspectives?
1-4: What are psychology’s main subfields?

The Need for Psychological Science
1-5: How do hindsight bias, overconfidence, and the tendency to perceive order in random events illustrate why science-based answers are more valid than those based on intuition and common sense?
1-6: How do the scientific attitude's three main components relate to critical thinking?

How Do Psychologists Ask and Answer Questions?
1-7: How do theories advance psychological science?
1-8: How do psychologists use case studies, naturalistic observations, and surveys to observe and describe behavior, and why is random sampling important?
1-9: What are positive and negative correlations, and why do they enable prediction but not cause-effect explanation?
1-10: What are the characteristics of experimentation that make it possible to isolate cause and effect?

Frequently Asked Questions About Psychology
1-11: Can laboratory experiments illuminate everyday life?
1-12: Does behavior depend on one’s culture and gender?
1-13: Why do psychologists study animals, and what ethical guidelines safeguard human and animal research participants?
1-14: Is psychology free of value judgments?

Improve Your Retention—and Your Grades
1-15: How can psychological principles help you learn and remember?
**TERMS AND CONCEPTS TO REMEMBER**

Test yourself on these terms by trying to write down the definition in your own words before flipping back to the referenced page to check your answer.

- structuralism, p. 3
- functionalism, p. 3
- behaviorism, p. 4
- humanistic psychology, p. 4
- cognitive neuroscience, p. 4
- psychology, p. 4
- nature-nurture issue, p. 5
- natural selection, p. 6
- levels of analysis, p. 6
- biopsychosocial approach, p. 6
- basic research, p. 9
- applied research, p. 9
- counseling psychology, p. 9
- clinical psychology, p. 9
- psychiatry, p. 9
- positive psychology, p. 9
- hindsight bias, p. 11
- critical thinking, p. 15
- theory, p. 15
- hypothesis, p. 16
- operational definition, p. 16
- replication, p. 16
- case study, p. 17
- naturalistic observation, p. 18
- survey, p. 19
- population, p. 20
- random sample, p. 20
- correlation, p. 20
- correlation coefficient, p. 20
- experiment, p. 22
- experimental group, p. 22
- control group, p. 22
- random assignment, p. 22
- double-blind procedure, p. 23
- placebo effect, p. 23
- independent variable, p. 24
- confounding variable, p. 24
- dependent variable, p. 24
- culture, p. 26
- informed consent, p. 28
- debriefing, p. 28
- testing effect, p. 29
- SQ3R, p. 29

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**EXPERIENCE THE TESTING EFFECT**

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. 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.

2. William James would be considered __________.
   Wilhelm Wundt and Edward Titchener would be considered __________.
   a. functionalist; structuralist
   b. structuralist; functionalist
   c. evolutionary theorist; structuralist
   d. functionalist; evolutionary theorist

3. 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

4. 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.

5. “Nurture works on what nature endows.” Describe what this means, using your own words.

6. 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.

7. A mental health professional with a medical degree who can prescribe medication is a __________.

8. A psychologist conducting basic research to expand psychology’s knowledge base would be most likely to
   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.

9. __________ refers to our tendency to perceive events as obvious or inevitable after the fact.

10. As scientists, psychologists
    a. approach research with a negative cynicism.
    b. assume that an article published in a reputable journal must be true.
    c. believe that every important human question can be studied scientifically.
    d. are willing to ask questions and to reject claims that cannot be verified by research.
11. How can you use your knowledge of the scientific attitude to help you evaluate claims in the media, even if you're not a scientific expert on the issue?

12. The predictions implied by a theory are called _____________.

13. Which of the following is NOT one of the techniques psychologists use to observe and describe behavior?
   a. A case study
   b. Naturalistic observation
   c. Correlational research
   d. A phone survey

14. You wish to take an accurate poll in a certain country by questioning people who truly represent the country’s adult population. Therefore, you need to ensure that you question a ____________ sample of the population.

15. 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.

16. 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.

17. 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.)

18. To explain behaviors and clarify cause and effect, psychologists use _____________.

19. 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 is a _____________.

20. 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.

21. 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 _____________.

22. The laboratory environment is designed to
   a. exactly re-create the events of everyday life.
   b. re-create psychological forces under controlled conditions.
   c. create opportunities for naturalistic observation.
   d. minimize the use of animals and humans in psychological research.

23. 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.

24. 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. advancing the well-being of humans justifies animal experimentation.
   d. All of these statements are correct.

Find answers to these questions in Appendix E, in the back of the book.