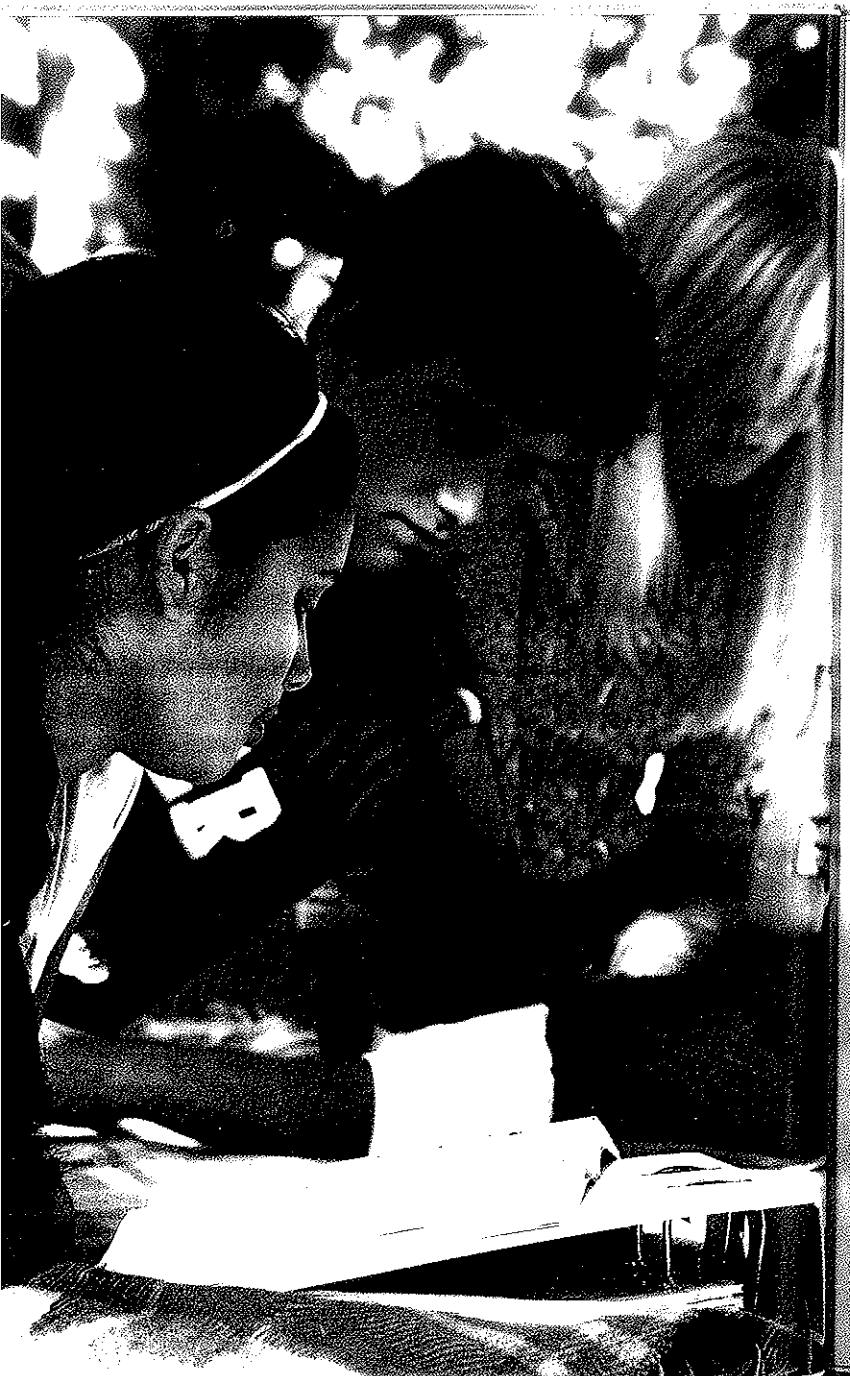

UNIT 1

Psychology's History and Approaches

> "I have made a ceaseless effort not to ridicule, not to bewail, not to scorn human actions, but to understand them."
>
> Benedict Spinoza, *A Political Treatise*, 1677

Harvard astronomer Owen Gingerich (2006) reports that there are more than 100 billion galaxies. Just one of these, our own relative speck of a galaxy, has some 200 billion stars, many of which, like our Sun-star, are circled by planets. On the scale of outer space, we are less than a single grain of sand on all the oceans' beaches, and our lifetime but a relative nanosecond.

Yet there is nothing more awe inspiring and absorbing than our own inner space. Our brain, adds Gingerich, "is by far the most complex physical object known to us in the entire cosmos" (p. 29). Our consciousness—mind somehow arising from matter—remains a profound mystery. Our thinking, emotions, and actions (and their interplay with others' thinking, emotions, and actions) fascinate us. Outer space staggers us with its enormity, but inner space enthralls us. Enter psychological science.

For people whose exposure to psychology comes from pop-culture Web sites, books, magazines, and TV, psychologists analyze personality, offer counseling, and dispense child-rearing advice. Do they? Yes, and much more. Consider some of psychology's questions that from time to time you may wonder about:

- Have you ever found yourself reacting to something as one of your biological parents would—perhaps in a way you vowed you never would—and then wondered how much of your personality you inherited? *To what extent are person-to-person differences in personality predisposed by our genes? To what extent by the home and community environments?*
- Have you ever worried about how to act among people of a different culture, race, or gender? *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 later out of thin air. *What do babies actually perceive and think?*
- Have you ever wondered what leads to school and work success? Are some people just born smarter? *Does sheer intelligence explain why some people get richer, think more creatively, or relate more sensitively?*

A smile is a smile the world around Throughout this book, you will see examples not only of our cultural and gender diversity but also of the similarities that define our shared human nature. People in different cultures vary in when and how often they smile, but a naturally happy smile *means* the same thing anywhere in the world.


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Andrew Von Luenen/Corbis

- Have you ever become depressed or anxious and wondered whether you'll ever feel "normal"? *What triggers our bad moods—and our good ones?*

Such questions provide grist for psychology's mill, because psychology is a science that seeks to answer all sorts of questions about us all—how and why we think, feel, and act as we do.

What Is Psychology?

Psychology's Roots

ONCE UPON A TIME, ON A PLANET IN this neighborhood of the universe, there came to be people. Soon thereafter, these creatures became intensely interested in themselves and in one another: *Who are we? What produces our thoughts? Our feelings? Our actions? And how are we to understand and manage those around us?*

◦ To assist your active learning, I will periodically offer learning objectives. These will be framed as questions that you can answer as you read on. ◦

Prescientific Psychology

1: How did psychology develop from its prescientific roots in early understandings of mind and body to the beginnings of modern science?

We can trace many of psychology's current questions back through human history. These early thinkers wondered: How do our minds work? How do our bodies relate to our minds? How much of what we know comes built in? How much is acquired through experience? In India, Buddha pondered how sensations and perceptions combine to form ideas. In China, Confucius stressed the power of ideas and of an educated mind. In ancient Israel, Hebrew scholars anticipated today's psychology by linking mind and emotion to the body; people were said to think with their heart and feel with their bowels.

In ancient Greece, the philosopher-teacher Socrates (469–399 B.C.E.) and his student Plato (428–348 B.C.E.) concluded that mind is separable from body and continues after the body dies, and that knowledge is innate—born within us. Unlike Socrates and Plato, who derived principles by logic, Plato's student Aristotle (384–322 B.C.E.) had a love of data. An intellectual ancestor of today's scientists, Aristotle

derived principles from careful observations. Moreover, he said knowledge is *not* preexisting (sorry, Socrates and Plato); instead it grows from the experiences stored in our memories.

The next 2000 years brought few enduring new insights into human nature, but that changed in the 1600s, when modern science began to flourish. With it came new theories of human behavior, and new versions of the ancient debates. A frail but brilliant Frenchman named René Descartes (1595–1650) agreed with Socrates and Plato about the existence of innate ideas and mind's being "entirely distinct from body" and able to survive its death. Descartes' concept of mind forced him to conjecture, as people have ever since, how the immaterial mind and physical body communicate. A scientist as well as a philosopher, Descartes dissected animals and concluded that the fluid in the brain's cavities contained "animal spirits." These spirits, he surmised, flowed from the brain through what we call the nerves (which he thought were hollow) to the muscles, provoking movement. Memories formed as experiences opened pores in the brain into which the animal spirits also flowed.

Descartes was right that nerve paths are important and that they enable reflexes. Yet, genius though he was, and standing upon the knowledge accumulated from 99+ percent of our human history, he hardly had a clue of what today's average 12-year-old knows. Indeed, most of the scientific story of our self-exploration—the story told in this book—has been written in but the last historical eyeblink of human time.


Bettmann/Corbis

A seventeenth-of nerves In his *Man*, Descartes p hydraulics of a si

Meanwhile, across the English Channel in Britain, science was taking a more down-to-earth form, centered on experiment, experience, and common-sense judgment. Francis Bacon (1561–1626) became one of the founders of modern science, and his influence lingers in the experiments of today's psychological science. Bacon also was fascinated by the human mind and its failings. Anticipating what we have come to appreciate about our mind's hunger to perceive patterns even in random events, he wrote that "the human understanding, from its peculiar nature, easily supposes a greater degree of order and equality in things than it really finds" (*Novum Organuum*). He also foresaw research findings on our noticing and remembering events that confirm our beliefs: "All superstition is much the same whether it be that of astrology, dreams, omens . . . in all of which the deluded believers observe events which are fulfilled, but neglect and pass over their failure, though it be much more common."

Some 50 years after Bacon's death, John Locke (1632–1704), a British political philosopher, sat down to write a one-page essay on "our own abilities" for an upcoming discussion with friends. After 20 years and hundreds of pages, Locke had completed one of history's greatest late papers (*An Essay Concerning Human Understanding*), in which he famously argued that the mind at birth is a *tabula rasa*—a "blank slate"—on which experience writes. This idea, adding to Bacon's ideas, helped form modern **empiricism**, the view that knowledge originates in experience and that science should, therefore, rely on observation and experimentation.

◦ Throughout the text, ir concepts are boldfaced. study, you can find thes their definitions in a nea and in the Glossary at th the book. ◦

empiricism the view tha originates in experience a ence should, therefore, rel tion and experimentation.

Wilhelm Wundt Wundt (far left) established the first psychology laboratory at the University of Leipzig, Germany.

◦ Information sources are cited in parentheses, with name and date. Every citation can be found in the end-of-book References, with complete documentation that follows American Psychological Association style. ◦

Psychological Science Is Born

2: When and how did modern psychological science begin?

Philosophers' thinking about thinking continued until the birth of psychology as we know it, 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. Thus began what many consider psychology's first experiment, launching the first psychological laboratory, staffed by Wundt and 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. These early schools included *structuralism*, *functionalism*, and *behaviorism*, described here (with more on behaviorism in Unit 6), and two schools described in later units: Gestalt psychology (Unit 4) and psychoanalysis (Unit 10).

Thinking About the Mind's Structure

Soon after receiving his Ph.D. in 1892, Wundt's student Edward Bradford Titchener joined the Cornell University faculty and introduced **structuralism**. As physicists and chemists discerned the structure of matter, so Titchener aimed to discover the structural elements of mind. His method was to engage 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? Titchener 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).

Alas, introspection required smart, verbal people. It also proved somewhat unreliable, its results varying from person to person and experience to experience. Moreover, we often just don't know why we feel what we feel and do what we do. Recent studies indicate that people's recollections frequently err. So do their self-reports about what, for example, has caused them to help or hurt another (Myers, 2002). As introspection waned, so did structuralism.

Edward Bradford Titchener Titchener used introspection to search for the mind's structural elements.

Thinking About the Mind's Functions

Unlike those hoping to assemble the structure of mind from simple elements—which was rather like trying to understand a car by examining its disconnected parts—philosopher-psychologist William James thought it 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 circumstances, 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.

::**structuralism** an early school of psychology that used introspection to explore the structural elements of the human mind.

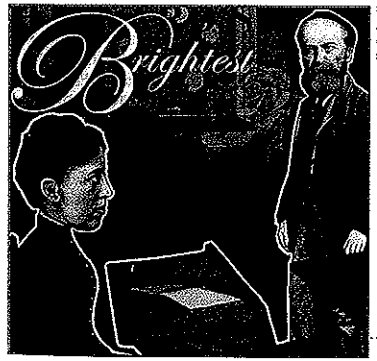
::**functionalism** a school of psychology that focused on how our mental and behavioral processes function—how they enable us to adapt, survive, and flourish.

James' greatest legacy, however, came less from his laboratory than from his Harvard teaching and his writing. When not plagued by ill health and depression, James was an impish, outgoing, and joyous man, who once recalled that "the first lecture on psychology I ever heard was the first I ever gave." During one of his wise-cracking lectures, a student interrupted and asked him to get serious (Hunt, 1993). He loved his students, his family, and the world of ideas, but he tired of painstaking chores such as proofreading. "Send me no proofs!" he once told an editor. "I will return them unopened and never speak to you again" (Hunt, 1993, p.145).

James displayed the same spunk in 1890, when—over the objections of Harvard's president—he admitted Mary 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 the requirements for a Harvard Ph.D., 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. (More than a century later, psychologists and psychology students were lobbying Harvard to posthumously award Calkins the Ph.D. she earned [*Feminist Psychologist*, 2002].) Calkins nevertheless went on to become a distinguished memory researcher and the American Psychological Association's (APA's) first female president in 1905.

When Harvard denied Calkins the claim to being psychology's first female psychology Ph.D., that honor fell to Margaret Floy Washburn, who later wrote an influential book, *The Animal Mind*, and became the second female APA president in 1921. Although

"You don't know your own mind."
Jonathan Swift
Polite Conversation, 1738



William James and Mary Whiton Calkins James, legendary teacher-writer, 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*.

::**experimental psychology** the study of behavior and thinking using the experimental method.

::**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 and the individual's potential for personal growth.

::**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.

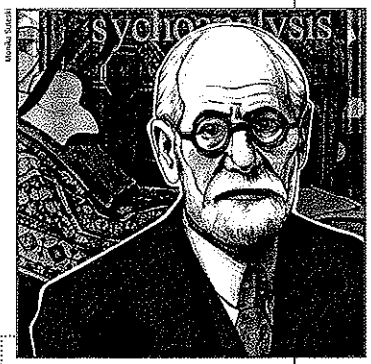
Washburn's thesis was the first foreign study Wundt published in his journal, her gender meant she was barred from joining the organization of **experimental psychologists** (who explore behavior and thinking with experiments), despite its being founded by Titchener, her own graduate adviser (Johnson, 1997). What a different world from the recent past—1996 to 2009—when women claimed two-thirds or more of new U.S. psychology Ph.D.s and were 6 of the 13 elected presidents of the science-oriented Association for Psychological Science. In Canada and Europe, too, most recent psychology doctorates have been earned by women.

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

Psychological Science Develops

3: How did psychology continue to develop from the 1920s through today?

The young science of psychology developed from the more established fields of philosophy and biology. Wundt was both a philosopher and a physiologist. James was an American philosopher. Ivan Pavlov, who pioneered the study of learning, was a Russian physiologist. Sigmund Freud, who developed the influential *psychoanalytic* theory of personality, was an Austrian physician. Jean Piaget, the last century's most influential observer of children, was a Swiss biologist. 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.



Monika Sutecki

Sigmund Freud The controversial ideas of this famed personality theorist and therapist have influenced humanity's self-understanding. ▲

The rest of the story of psychology—the subject of this book—develops at many levels. With pursuits ranging from the study of nerve cell activity to the study of international conflicts, *psychology* is not easily defined.

In psychology's early days, Wundt and Titchener focused on inner sensations, images, and feelings. James, too, engaged in introspective examination of the stream of consciousness and of emotion. Freud emphasized the ways emotional responses to childhood experiences and our unconscious thought processes affect our behavior. Thus, until the 1920s, *psychology* was defined as "the science of mental life."

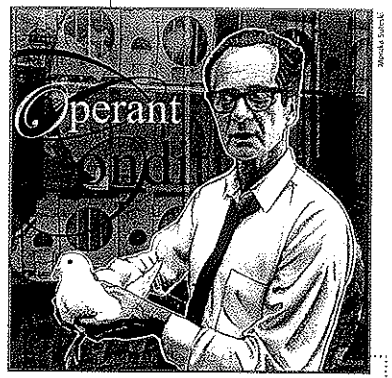
From the 1920s into the 1960s, American psychologists, initially led by flamboyant and provocative John B. Watson and later by the equally provocative B. F. Skinner, dismissed introspection and redefined *psychology* as "the scientific study of observable behavior." After all, said these **behaviorists**, science is rooted in observation. You cannot observe a sensation, a feeling, or a thought, but you *can* observe and record people's *behavior* as they respond to different situations. (More on these psychologists in Unit 6.)

During the 1960s and beyond, **humanistic psychology** rebelled against Freudian psychology and behaviorism. Pioneers Carl Rogers and Abraham Maslow found behaviorism's focus on learned behaviors too mechanistic. Rather than focusing on the meaning of early childhood memories, as a psychoanalyst might, the humanistic psychologists emphasized the importance of current environmental influences on our growth potential, and the importance of having our needs for love and acceptance satisfied. (More on this in Unit 10.)

In the 1960s, another movement emerged as psychology began to recapture its initial interest in mental processes. This *cognitive revolution* supported ideas developed by


Monika Sutecki

John B. Watson and Rosalie Rayner Working with Rayner, Watson championed psychology as the science of behavior and demonstrated conditioned responses in a baby who became famous as "Little Albert." ▲



Monika Sutecki

B. F. Skinner A leading behaviorist, Skinner rejected introspection and studied how consequences shape behavior. ▲

earlier psychologists, such as the importance of how our mind processes and retains information. But cognitive psychology and more recently **cognitive neuroscience** (the study of brain activity linked with mental activity) have expanded upon those ideas to explore scientifically the ways we perceive, process, and remember information. This approach has been especially beneficial in helping to develop new ways to understand and treat disorders such as depression, as we shall see in Units 12 and 13.

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, as I will emphasize throughout this book, 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.

BEFORE YOU MOVE ON . . .

➤ **ASK YOURSELF**

How do you think psychology might change as more people from non-Western countries contribute their ideas to the field?

➤ **TEST YOURSELF 1**

What event defined the founding of modern scientific psychology?

Answers to the Test Yourself questions can be found in Appendix E at the end of the book.

◦ These "Before you move on . . ." sections will appear at the end of each main section of text. The *Ask Yourself* questions will help you make the material more meaningful to your own life (and therefore more memorable). If you can answer the *Test Yourself* questions, which will provide a review of the key points of the previous section, you are, indeed, ready to move on! You can check your answers to the Test Yourself Questions in Appendix E at the end of the book. ◦

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

::**natural selection** the principle that, among the range of inherited trait variations, those contributing to reproduction and survival will most likely be passed on to succeeding generations.

Contemporary Psychology

LIKE ITS PIONEERS, TODAY'S PSYCHOLOGISTS are citizens of many lands. The International Union of Psychological Science has 69 member nations, from Albania to Zimbabwe. Nearly everywhere, membership in psychological societies is mushrooming--from 4183 American Psychological Association members and affiliates in 1945 to nearly 150,000 today, with similarly rapid growth in the British Psychological Society (from 1100 to 45,000). In China, the first university psychology department began in 1978; by 2008 there were 200 (Tversky, 2008). Worldwide, some 500,000 people have been trained as psychologists, and 130,000 of them belong to European psychological organizations (Tikkanen, 2001). Moreover, thanks to international publications, joint meetings, and the Internet, collaboration and communication cross borders now more than ever. "We are moving rapidly toward a single world of psychological science," reports Robert Bjork (2000). Psychology is *growing* and it is *globalizing*.

Across the world, psychologists are debating enduring issues, viewing behavior from the differing perspectives offered by the subfields in which they teach, work, and do research.

Psychology's Biggest Question

4: What is psychology's historic big issue?

During its short history, psychology has wrestled with some issues that will reappear throughout this book. The biggest and most persistent is the **nature-nurture issue**--*the controversy over the relative contributions of biology and experience.* As we have seen, the origins of this debate are ancient. Do our human traits develop through experience, or are we born with them? The ancient Greeks debated this, with Plato assuming that character and intelligence are largely inherited and that certain ideas are also inborn, and Aristotle countering that there is nothing in the mind that does not first come in from the external world through the senses. In the 1600s, philosophers rekindled the debate. Locke rejected the notion of inborn ideas, suggesting that the mind is a blank slate on which experience writes. Descartes disagreed, believing that some ideas are innate.

Monika Sieleski

Charles Darwin Darwin argued that natural selection shapes behaviors as well as bodies.

Two centuries later, Descartes' views gained support from a curious naturalist. In 1831, an indifferent student but ardent collector of beetles, mollusks, and shells set sail on what was to prove a historic round-the-world journey. The 22-year-old voyager was Charles Darwin, and for some time afterward, he pondered the incredible species variation he had encountered, including tortoises on one island that differed from those on other islands of the region. Darwin's 1859 *On the Origin of Species* explained this diversity of life by proposing the evolutionary process of **natural selection**: From among chance variations, nature selects the traits that best enable an organism to survive and reproduce in a particular environment. Darwin's principle of natural selection--"the single best idea anyone has ever had," says philosopher Daniel Dennett (1996)--is still with us 150 years later as an organizing principle of biology. Evolution also has become 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 debate weaves a thread from the ancient Greeks' time to our own. Today's psychologists explore the issue by asking, for example:

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

Such debates continue. Yet over and 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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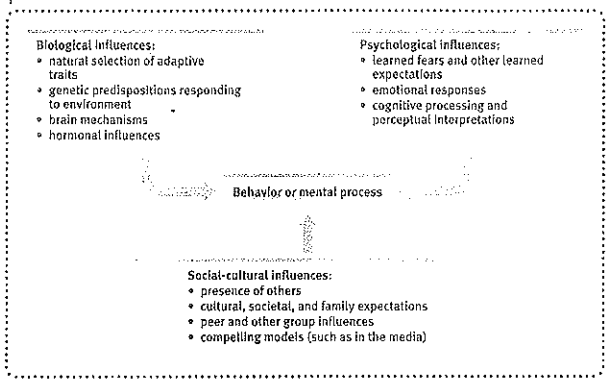
Veer Marketplace

A nature-made nature-nurture experiment Because identical twins have the same genes, they are ideal participants in studies designed to shed light on hereditary and environmental influences on intelligence, personality, and other traits. Studies of identical and fraternal twins provide a rich array of findings--described in later units--that underscore the importance of both nature and nurture.

Psychology's Three Main Levels of Analysis

5: 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.



➤ FIGURE 1.1
Biopsychosocial approach This integrated viewpoint incorporates various levels of analysis and offers a more complete picture of any given behavior or mental process.

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 an integrated **biopsychosocial approach**, which considers the influences of biological, psychological, and social-cultural factors (FIGURE 1.1).

Each level provides a valuable vantage point for looking at behavior, yet each by itself is incomplete. Like different academic disciplines, psychology's varied approaches, or perspectives, ask different questions and have their own limits. One perspective may stress the biological, psychological, or social-cultural level more than another, but the different perspectives described in TABLE 1.1 complement one another. Consider, for example, how they shed light on anger.

- Someone working from a **biological** perspective might study brain circuits that cause us to be "red in the face" and "hot under the collar," or how heredity and experience influence our individual differences in temperament.
- Someone working from the **evolutionary** perspective might analyze how anger facilitated the survival of our ancestors' genes.
- Someone working from the **psychodynamic** perspective might view an outburst as an outlet for unconscious hostility.
- 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 *humanistic perspective* (a historically important approach) might have been interested in understanding how angry feelings affect a person's potential for growth and personal fulfillment.
- Someone working from the **social-cultural** perspective might explore how expressions of anger vary across cultural contexts.

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

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

::**biological psychology** a branch of psychology that studies the links between biological (including neuroscience and behavior genetics) and psychological processes.

::**evolutionary psychology** the study of the roots of behavior and mental processes using the principles of natural selection.

::**psychodynamic psychology** a branch of psychology that studies how unconscious drives and conflicts influence behavior, and uses that information to treat people with psychological disorders.

::**behavioral psychology** the scientific study of observable behavior, and its explanation by principles of learning.

::**cognitive psychology** the scientific study of all the mental activities associated with thinking, knowing, remembering, and communicating.

::**social-cultural psychology** the study of how situations and cultures affect our behavior and thinking.

TABLE 1.1

PSYCHOLOGY'S APPROACHES

Approach	Focus	Sample Questions
Biological	How the body and brain enable emotions, memories, and sensory experiences; how genes combine with environment to influence individual differences	How are messages transmitted within the body? How is blood chemistry linked with moods and motives? To what extent are traits such as intelligence, personality, sexual orientation, and depression attributable to our genes? To our environment?
Evolutionary	How the natural selection of traits promoted the survival of genes	How does evolution influence behavior tendencies?
Psychodynamic	How behavior springs from unconscious drives and conflicts	How can someone's personality traits and disorders be explained in terms of sexual and aggressive drives or as the disguised effects of unfulfilled wishes and childhood traumas?
Behavioral	How we learn observable responses	How do we learn to fear particular objects or situations? What is the best way to alter our behavior, say, to lose weight or stop smoking?
Cognitive	How we encode, process, store, and retrieve information	How do we use information in remembering? Reasoning? Solving problems?
Humanistic	How we meet our needs for love and acceptance and achieve self-fulfillment	How can we work toward fulfilling our potential? How can we overcome barriers to our personal growth?
Social-cultural	How behavior and thinking vary across situations and cultures	How are we humans alike as members of one human family? As products of different environmental contexts, how do we differ?

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.

So 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?" Instead, expect that psychology will help you understand why people think, feel, and act as they do. Then you should find the study of psychology fascinating and useful.

Views of anger How would each of psychology's levels of analysis explain what's going on here?

::**psychometrics** the scientific study of the measurement of human abilities, attitudes, and traits.

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

::**developmental psychology** the scientific study of physical, cognitive, and social change throughout the life span.

::**educational psychology** the study of how psychological processes affect and can enhance teaching and learning.

::**personality psychology** the study of an individual's characteristic pattern of thinking, feeling, and acting.

::**social psychology** the scientific study of how we think about, influence, and relate to one another.

::**applied research** scientific study that aims to solve practical problems.

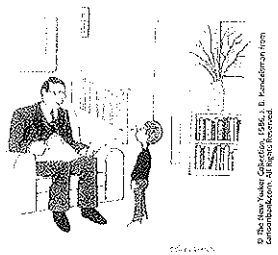
::**industrial-organizational (I/O) psychology** the application of psychological concepts and methods to optimizing human behavior in workplaces.

Psychology's Subfields

6: 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 life-styles" 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 researcher visiting another culture and collecting data on variations in human values and behaviors.
- a teacher or writer sharing the joy of psychology with others.



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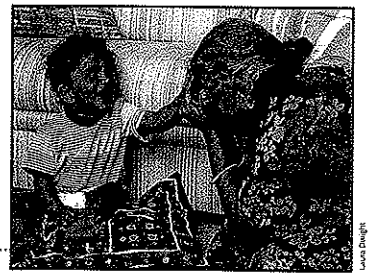
"I'm a social scientist, Michael. That means I can't explain electricity or anything like that, but if you ever want to know about people, I'm your man."

The cluster of subfields we call psychology has less unity than most other sciences. But there is a payoff: Psychology is a meeting ground for different disciplines. "Psychology is a hub scientific discipline," said Association for Psychological Science president John Cacioppo (2007). Thus, it's a perfect home for those with wide-ranging interests. In their diverse activities, from biological experimentation to cultural comparisons, the tribe of psychology is united by a common quest: describing and explaining behavior and the mind underlying it. There is even a branch of psychology devoted to studying the measurement of our abilities, attitudes, and traits: **psychometrics**.

I see you! A biological psychologist might view this child's delighted response as evidence of brain maturation. A cognitive psychologist might see it as a demonstration of the baby's growing knowledge of his surroundings. For a cross-cultural psychologist, the role of grandparents in different societies might be the issue of interest. As you will see throughout this book, these and other perspectives offer complementary views of behavior.



Laura Dwight

Some psychologists conduct **basic research** that builds psychology's knowledge base. In the pages that follow we 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.
- **educational psychologists** studying influences on teaching and learning.
- **personality psychologists** investigating our persistent traits.
- **social psychologists** exploring how we view and affect one another.

(For a more complete list of the major subfields of psychology, see Appendix A at the end of this text.)

These psychologists also may conduct **applied research** that tackles practical problems. So do other psychologists, including **industrial-organizational psychologists**, who 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. Within that domain, **human factors psychologists** focus on the interaction of people, machines, and physical environments. (More on this subject in Appendix B.)

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 (APA, 2003). 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 often provide psychotherapy, are medical doctors licensed to prescribe drugs and otherwise treat physical causes of psychological disorders. Some clinical psychologists are lobbying for a similar right to prescribe mental-health-related drugs, and in 2002 and 2004 New Mexico and Louisiana became the first states to grant that right to specially trained and licensed psychologists.

::**human factors psychology** the study of how people and machines interact and the design of safe and easily used machines and environments.

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

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

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

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.

Michael Newman/Photo Edit

©2007 John Koh hr

Bob Daemmrich/The Image Works

With perspectives ranging from the biological to the social, and with settings from the laboratory to the clinic, psychology relates to many fields, ranging from mathematics to biology to sociology to philosophy. And more and more, psychology's methods and findings aid other disciplines. Psychologists teach in medical schools, law schools, and high schools, and they work in hospitals, factories, and corporate offices. They engage in interdisciplinary studies, such as psychohistory (the psychological analysis of historical characters), psycholinguistics (the study of language and thinking), and psychoceramics (the study of crackpots).[1]

Psychology also influences modern culture. Knowledge transforms us. Learning about the solar system and the germ theory of disease alters the way people think and act. Learning 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," notes 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.

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

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

BEFORE YOU MOVE ON . . .

➢ **ASK YOURSELF**

When you signed up for this course, what did you think psychology would be all about?

➢ **TEST YOURSELF 2**

What are psychology's major levels of analysis?

Answers to the Test Yourself questions can be found in Appendix E at the end of the book.

» Want to learn more? See Appendix A, Careers in Psychology, at the end of this book for more information about psychology's subfields and to learn about the many interesting options available to those with bachelor's, master's, and doctoral degrees in psychology. «

CLOSE-UP

Tips for Studying Psychology

?: How can psychological principles help you as a student?

The investment you are making in studying psychology should enrich your life and enlarge your vision. 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 enrich us, by renewing our sense of mystery about "things too wonderful" for us yet to understand. Your study of psychology can also help teach you *how to ask and answer important questions*—how to think critically as you evaluate competing ideas and claims.

Having your life enriched and your vision enlarged (and getting a decent grade) requires effective study. As you will see in Unit 7A, 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 review and rehearse it again.

The **SQ3R** study method incorporates these principles (Robinson, 1970). SQ3R is an acronym for its five steps: Survey, Question, Read, Rehearse, Review.

To study a unit in this text, first *survey*, taking a bird's-eye view. Scan the headings, and notice how the unit is organized.

As you prepare to read each section, use its heading or numbered objective question to form a *question* you should answer. For this section, you might have asked, "How can I most effectively and efficiently master the information in this book?"

Then *read*, actively searching for the answer. At each sitting, read only as much of the unit (usually a single main section) as you can absorb without tiring. Read actively and critically. Ask questions. Make notes. Consider implications: 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, *rehearse* in your own words what you read. Test yourself by trying to answer your question, rehearsing what you can recall, then glancing back over what you can't recall.

Finally, *review*. Read over any notes you have taken, again with an eye on the unit's organization, and quickly review the whole unit.

Survey, question, read, rehearse, review. I have organized this book's units to facilitate your use of the SQ3R study system. Each unit begins with an outline that aids your *survey*. Headings and learning objective *questions* suggest issues and concepts you should consider as you *read*. The material is organized into sections of readable length. At the end of each section is a "Before you move on . . ." box with "Ask Yourself" and "Test Yourself" questions that help you *rehearse* what you know. The Unit *Review* provides answers to the learning objective questions, and the list of key terms helps you check your mastery of important concepts. Survey, question, read . . .

Five additional study tips may further boost your learning:

Distribute your study time. One of psychology's oldest findings is that *spaced practice* promotes better retention than *massed practice*. You'll remember material better if you space your work 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 unit in a single sitting, read just one main section and then turn to something else.

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 supported by reliable science? Assess conclusions. Are there alternative explanations?

In class, listen actively. Listen for the main ideas and sub-ideas of a lesson. *Write them down.* Ask questions during and after class. In class, as with your homework, 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."*

Overlearn. Psychology tells us that overlearning improves retention. We are prone to overestimating how much we know. You may understand a unit as you read it, but by devoting extra study time to testing yourself and reviewing what you think you know, you will retain your new knowledge long into the future.

Be a smart test-taker. If a test contains both multiple-choice questions and an essay question, turn first to the essay. Read the question carefully, noting exactly what the teacher is asking. On the back of a page, pencil in a list of points you'd like to make and then organize them. Before writing, put aside the essay and work through the multiple-choice questions. (As you do so, your mind may continue to mull over the essay question. Sometimes the multiple-choice questions will bring pertinent thoughts to mind.) Then reread the essay question, rethink your answer, and start writing. When you finish, proofread your answer to eliminate spelling and grammatical errors that make you look less competent than you are.

When reading multiple-choice questions, don't confuse yourself by trying to imagine how each choice might be the right one. Instead, try to answer each question as if it were a fill-in-the-blank question. First cover the answers and form a sentence in your mind, recalling what you know to complete the sentence. Then read the answers on the test and find the alternative that best matches your own answer.

While exploring psychology, you will learn much more than effective study techniques. 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."

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

UNIT REVIEW: Psychology's History and Approaches

What Is Psychology?

1: How did psychology develop from its prescientific roots in early understandings of mind and body to the beginnings of modern science?
Psychology traces its roots back through recorded history to India, China, the Middle East, and Europe. Buddha and Confucius focused on the powers and origin of ideas. The ancient Hebrews, Socrates, Plato, and Aristotle pondered whether mind and body are connected or distinct, and whether human ideas are innate or result from experience. Descartes and Locke reengaged those ancient debates, with Locke offering his famous description of the mind as a "blank slate" on which experience writes. The ideas of Bacon and Locke contributed to the development of modern *empiricism*.

2: When and how did modern psychological science begin?
Psychological science had its modern beginning with the first psychological laboratory, founded in 1879 by German philosopher and physiologist Wilhelm Wundt, and from the later work of other scholars from several disciplines and many countries.

3: How did psychology continue to develop from the 1920s through today?
Having begun as a "science of mental life," psychology evolved in the 1920s into the "scientific study of observable behavior." After rediscovering the mind, *psychology* since the 1960s has been widely defined as the *science of behavior and mental processes*.

Contemporary Psychology

4: What is psychology's historic big issue?
Psychology's biggest and most enduring issue concerns the relative contributions and interplay between the influences of *nature* (genes) and *nurture* (all other influences, from conception to death). Today's science emphasizes the interaction of genes and experiences in specific environments.

5: What are psychology's levels of analysis and related perspectives?
The *biopsychosocial approach* integrates information from the biological, psychological, and social-cultural *levels of analysis*. Psychologists study human behaviors and mental processes from many different perspectives (including the *biological, evolutionary, psychodynamic, behavioral, cognitive,* and *social-cultural perspectives*, and the historically influential *humanistic* approach).

6: What are psychology's main subfields?
Psychology's subfields encompass *basic research* (often done by biological, *developmental*, cognitive, *educational*, *personality*, and *social psychologists*), *applied research* (sometimes conducted by *industrial-organizational* and *human factors psychologists*), and clinical science and applications (the work of *counseling psychologists* and *clinical psychologists*). *Psychometric* psychologists study measurement methods. Clinical psychologists study, assess, and treat (with psychotherapy) people with psychological disorders. *Psychiatrists* also study, assess, and treat people with disorders, but as medical doctors, they may prescribe drugs in addition to psychotherapy.

7: How can psychological principles help you as a student?
Research has shown that learning and memory are enhanced by active study. The *SQ3R* study method--survey, question, read, rehearse, and review--applies the principles derived from this research.

Terms and Concepts to Remember

empiricism, p. 3
structuralism, p. 4
functionalism, p. 5
experimental psychology, p. 6
behaviorism, p. 6
humanistic psychology, p. 6
cognitive neuroscience, p. 7
psychology, p. 7
nature-nurture issue, p. 8
natural selection, p. 8
levels of analysis, p. 10
biopsychosocial approach, p. 10
biological psychology, p. 10
evolutionary psychology, p. 10
psychodynamic psychology, p. 10
behavioral psychology, p. 10
cognitive psychology, p. 10
social-cultural psychology, p. 10
psychometrics, p. 12
basic research, p. 13
developmental psychology, p. 13
educational psychology, p. 13
personality psychology, p. 13
social psychology, p. 13
applied research, p. 13
industrial-organizational (I/O) psychology, p. 13
human factors psychology, p. 13
counseling psychology, p. 13
clinical psychology, p. 13
psychiatry, p. 13
SQ3R, p. 14

AP* Practice Test Questions

Multiple-Choice Questions

1. Which perspective would most likely explain anger as "an outlet for unconscious hostility"?
   a. Social-cultural
   b. Psychodynamic
   c. Behavioral
   d. Functionalist
   e. Biological

2. The debate on the relative contributions of biology and experience to human development is most often referred to as
   a. evolutionary analysis.
   b. behaviorism.
   c. the cognitive revolution.
   d. the nature-nurture issue.
   e. natural selection.

3. Which of the following professionals is also a medical doctor?
   a. Psychiatrist
   b. Psychologist
   c. Clinician
   d. Counselor
   e. Biologist

4. SQ3R is an acronym for a study method that includes survey, question, read, rehearse, and
   a. rigor.
   b. recite.
   c. response.
   d. review.
   e. reserve.

5. Which of the following psychologists would most likely explore how we view and affect each other?
   a. Developmental
   b. Biological
   c. Social
   d. Cognitive
   e. Personality

6. For behaviorists, psychological science is rooted in
   a. introspection.
   b. observation.
   c. cultural influences.
   d. growth potential.
   e. basic needs.

7. Which of the following psychologists would most likely conduct psychotherapy?
   a. Biological
   b. Clinical
   c. Industrial-organizational
   d. Cognitive
   e. Evolutionary

8. The study of mental activity linked with brain activity best describes
   a. humanistic psychology.
   b. Gestalt psychology.
   c. cognitive neuroscience.
   d. the psychodynamic perspective.
   e. the evolutionary perspective.

9. The first psychological laboratory, opened in 1879, belonged to
   a. Charles Darwin.
   b. Sigmund Freud.
   c. René Descartes.
   d. Wilhelm Wundt.
   e. William James.

10. The _____ school of psychology focused on how mental and behavioral processes enable us to adapt and flourish.
    a. Functionalist
    b. Structuralist
    c. Behavioral
    d. Humanistic
    e. Psychodynamic

11. The study of current environmental influences and the importance of satisfying the needs for love and acceptance best describe which school of psychology?
    a. Humanistic
    b. Behaviorial
    c. Psychodynamic
    d. Structuralist
    e. Functionalist

12. Which of the following is the best example of applied research?
    a. Investigating basic human traits.
    b. Using psychological concepts to boost morale and productivity.
    c. Experimenting with how we perceive stimuli.
    d. Studying the changing abilities of a child from age 2 to age 5.
    e. Exploring the mind-brain connections in adolescents.

13. Self-reflective introspection (looking inward) to discern the elements of experience best describes a technique used by
    a. Darwinists.
    b. empiricists.
    c. structuralists.
    d. behaviorists.
    e. ancient Greek philosophers.

14. Which perspective would most look at how our *interpretation* of a situation affects how we react to it?
    a. Psychodynamic
    b. Cognitive
    c. Biological
    d. Social-cultural
    e. Evolutionary

15. The science of behavior and mental processes best defines
    a. philosophy.
    b. cognitive neuroscience.
    c. basic research.
    d. applied research.
    e. psychology.

Free-Response Question

Psychology has a variety of complementary yet incomplete perspectives that help us understand behavior. How might each of the following perspectives explain aggression?

- Biological
- Cognitive
- Evolutionary
- Social-cultural

WEB
Multiple-choice self-tests and more may be found at www.worthpublishers.com/myers

UNIT 2

Research Methods: 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, read articles on psychic powers, attend stop-smoking hypnosis seminars, and devote countless hours to Web pages 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? Should we trust childhood sexual abuse memories that get "recovered" in adulthood—and prosecute the alleged predators? Are firstborn children more driven 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?*

The Need for Psychological Science

1. Why are the answers that flow from the scientific approach more reliable 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 everyone knows?" Others place their faith in human intuition: "Buried deep within each and every one of us, there is an instinctive, heart-felt awareness that provides—if we allow it to—the most reliable guide," offered Prince Charles (2000). "I know there's no evidence that shows the death penalty has a deterrent effect," George W. Bush (1999) reportedly said as Texas governor, "but I just feel in my gut it must be true." "I'm a gut player. I rely on my instincts," said the former president in explaining to Bob Woodward (2002) his decision to launch the Iraq war.

Prince Charles and former President Bush have much company. A long list of pop psychology books encourage us toward "intuitive managing," "intuitive trading," "intuitive healing," and much more. 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 automatically, offscreen. 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. Intuition is important, but we often underestimate its perils. My geographical intuition tells me that

Jim Wells/Sipa Press/Newscom

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.

"He who trusts in his own heart is a fool."
Proverbs 28:26

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

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

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

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.

Units to come will show that experiments have found people greatly overestimating their lie detection accuracy, their eyewitness recollections, their interviewee assessments, their risk predictions, and their stock-picking talents. "The first principle," said Richard Feynman (1997), "is that you must not fool yourself—and you are the easiest person to fool."

Indeed, observed Madeleine L'Engle, "The naked intellect is an extraordinarily inaccurate instrument" (1973). Two phenomena—hindsight bias and judgmental overconfidence—illustrate why we cannot rely solely on intuition and common sense.

Did We Know It All Along? Hindsight Bias

How easy it is to seem astute when drawing the bull's eye after the arrow has struck. After the North Tower of New York's World Trade Center was hit on September 11, 2001, commentators said people in the South Tower *should* have immediately evacuated. (It became obvious only later that the strike was not an accident.) After the U.S. occupation of Iraq led to a bloody civil war rather than a peaceful democracy, commentators saw the result as inevitable. *Before* the invasion was launched, these results seemed anything but obvious: In voting to allow the Iraq invasion, most U.S. senators did not anticipate the chaos that would seem so predictable in hindsight. Finding that something has happened makes it seem inevitable, a tendency we call **hindsight bias** (also known as the *I-knew-it-all-along phenomenon*).

This 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 regard 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 they overwhelmingly see it as unsurprising common sense. Obviously, when both a supposed finding and its opposite 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. As physicist Neils Bohr reportedly said, "Prediction is very difficult, especially about the future."

Hindsight bias is widespread. Some 100 studies have observed it in various countries and among both children and adults (Blank et al., 2007). Nevertheless, our 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 Unit 8A calls a deep "need to belong"). Indeed, note Daniel Gilbert, Brett Pelham, and Douglas Krull (2003), "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.

But sometimes our intuition, informed by countless casual observations, has it wrong. In later units we will see how research has overturned popular ideas—that familiarity breeds contempt, that dreams predict the future, and that emotional reactions coincide with menstrual phase. (See also TABLE 2.1.) We will also see how it 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.

AP Photo/The Roanoke Times, Matt Gentry

Hindsight bias *After* the horror of 9/11, it seemed obvious that the U.S. intelligence analysts should have taken advance warnings more seriously, that airport security should have anticipated box-cutter–wielding terrorists, that occupants of the South Tower of the World Trade Center should have known to play it safe and leave. With 20/20 hindsight, everything seems obvious. Thus we now spend billions to protect ourselves against what the terrorists did last time. ▲

TABLE 2.1

TRUE OR FALSE?

Psychological research discussed in units to come will either confirm or refute each of these statements (adapted, in part, from Furnham et al., 2003). Can you predict which of these popular ideas have been confirmed and which refuted? (Check your answers at the bottom of this table.)

1. If you want to teach a habit that persists, reward the desired behavior every time, not just intermittently (see Unit 6).
2. Patients whose brains are surgically split down the middle survive and function much as they did before the surgery (see Unit 3B).
3. Traumatic experiences, such as sexual abuse or surviving the Holocaust, are typically "repressed" from memory (see Unit 7A).
4. Most abused children do *not* become abusive adults (see Unit 9).
5. Most infants recognize their own reflection in a mirror by the end of their first year (see Unit 9).
6. Adopted siblings usually do not develop similar personalities, even though they are reared by the same parents (see Unit 3C).
7. Fears of harmless objects, such as flowers, are just as easy to acquire as fears of potentially dangerous objects, such as snakes (see Unit 8A).
8. Lie detection tests often lie (see Unit 8B).
9. Most of us use only about 10 percent of our brains (see Unit 3B).
10. The brain remains active during sleep (see Unit 5).

Answers: 1. F, 2. T, 3. F, 4. T, 5. T, 6. F, 7. T, 8. T, 9. F, 10. T

Overconfidence

We humans tend to be overconfident. As Unit 7B explains, we tend to think we know more than we do. Asked how sure we are of our answers to factual questions (Is Boston north or south of Paris?), we tend to be more confident than correct.[1] Or consider these three anagrams, which Richard Goranson (1978) asked people to unscramble:

[1]Boston is south of Paris.

= Fun anagram solutions from Wordsmith.org:
Elvis = lives
Dormitory = dirty room
Slot machines = cash lost in 'em. =

"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

"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

"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 scientist . . . must be free to ask any question, to doubt any assertion, to seek for any evidence, to correct any errors."
Physicist J. Robert Oppenheimer, *Life*, October 10, 1949

WREAT → WATER
ETRYN → ENTRY
GRABE → BARGE

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

Once people know the answer, hindsight makes it seem obvious—so much so that they become overconfident. They think they would have seen the solution in only 10 seconds or so, when in reality the average problem solver spends 3 minutes, as you also might, given a similar anagram without the solution: OCHSA. (See margin on opposite page to check your answer.)

Are we any better at predicting our social behavior? To find out, Robert Vallone and his associates (1990) had students predict at the beginning of the school year whether they would drop a course, vote in an upcoming election, call their parents more than twice a month, and so forth. On average, the students felt 84 percent confident in making these self-predictions. Later quizzes about their actual behavior showed their predictions were only 71 percent correct. Even when students were 100 percent sure of themselves, their self-predictions erred 15 percent of the time.

It's not just students. Ohio State University psychologist Philip Tetlock (1998, 2005) has 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."

The point to remember: Hindsight bias and overconfidence often lead us to overestimate our intuition. But scientific inquiry can help us sift reality from illusion.

The Scientific Attitude

2: What are three main components of the scientific attitude?

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. To answer them in any way requires a leap of faith. With many other ideas (Can some people demonstrate ESP?), the proof is in the pudding. No matter how sensible or crazy an idea sounds, the critical thinker's question is, *Does it work?* When put to the test, can its predictions be confirmed?

This scientific approach has a long history. As ancient a figure as Moses used such an approach. How do you evaluate a self-proclaimed prophet? His answer: Put the prophet to the test. If the predicted event "does not take place or prove true," then so much the worse for the prophet (Deuteronomy 18:22). By letting the facts speak for themselves, Moses was using what we now call an *empirical approach*. Magician James Randi uses this 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 has told me that no aura-seer has agreed to take this simple test.

When subjected to such scrutiny, crazy-sounding ideas sometimes find support. During the 1700s, scientists scoffed at the notion that meteorites had extraterrestrial origins. When two Yale scientists dared to deviate from the conventional opinion, Thomas Jefferson jeered, "Gentlemen, I would rather believe that those two Yankee Professors would lie than to believe that stones fell from heaven." Sometimes scientific inquiry turns jeers into cheers.

More often, science becomes society's garbage disposal by 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. Today's "truths" sometimes become tomorrow's fallacies. 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?*

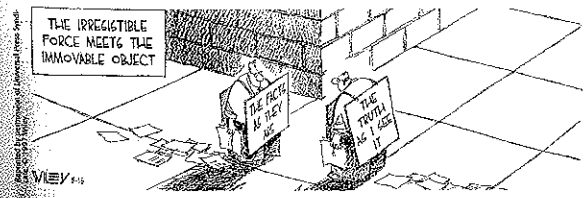
When ideas compete, skeptical testing can reveal which ones best match the facts. Do parental behaviors determine children's sexual orientation? Can astrologers predict your future based on the position of the planets at your birth? As we will see, putting such claims to the test has led psychological scientists to doubt them.

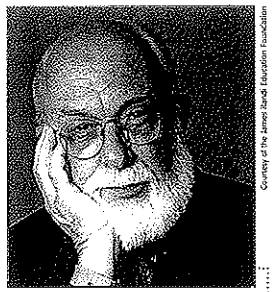
Putting a scientific attitude into practice requires not only skepticism but also *humility*—an awareness of our own vulnerability to error and an openness to surprises and new perspectives. In the last analysis, what matters is not my opinion or yours, but the truths nature reveals in response to our 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. Many of its founders, including Copernicus and Newton, were people whose religious convictions made them humble before nature and skeptical of mere human authority (Hooykaas, 1972; Merton, 1938). Some deeply religious people today may view science, including psychological science, as a threat. Yet, notes sociologist Rodney Stark (2003a,b), the scientific revolution was led mostly by 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."

Of course, scientists, like anyone else, can have big egos and may cling to their preconceptions. We all view nature through the spectacles of our preconceived ideas. Nevertheless, the ideal that unifies psychologists with all scientists is the curious, skeptical, humble scrutiny of competing ideas. As a community, scientists check and recheck one another's findings and conclusions.

Non Sequitur





Courtesy of the James Randi Education Foundation

The Amazing Randi The magician James Randi exemplifies skepticism. He has tested and debunked a variety of psychic phenomena.

"A skeptic is one who is willing to question any truth claim, asking for clarity in definition, consistency in logic, and adequacy of evidence."
Philosopher Paul Kurtz
The Skeptical Inquirer, 1994

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

« Solution to anagram on previous page: CHAOS.

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

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 units illustrate, is plainly *yes*. Believe it or not . . .

- massive losses of brain tissue early in life may have minimal long-term effects (see Unit 3B).
- within days, newborns can recognize their mother's odor and voice (see Unit 9).
- brain damage can leave a person able to learn new skills yet unaware of such learning (see Unit 7B).
- diverse groups—men and women, old and young, rich and middle class, those with disabilities and those without—report roughly comparable levels of personal happiness (see Unit 8B).
- electroconvulsive therapy (delivering an electric shock to the brain) is often a very effective treatment for severe depression (see Unit 13).

And has critical inquiry convincingly debunked popular presumptions? The answer, as ensuing units also illustrate, is again *yes*. The evidence indicates that . . .

- sleepwalkers are *not* acting out their dreams (see Unit 5).
- 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 Unit 7A).
- most people do *not* suffer from unrealistically low self-esteem, and high self-esteem is not all good (see Unit 10).
- opposites do *not* generally attract (see Unit 14).

In each of these instances and more, what has been 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

BEFORE YOU MOVE ON . . .

➤ **ASK YOURSELF**

How might critical thinking help us assess someone's interpretations of people's dreams or their claims to communicate with the dead?

➤ **TEST YOURSELF 1**

What is the scientific attitude, and why is it important for critical thinking?

Answers to the Test Yourself questions can be found in Appendix E at the end of the book.

How Do Psychologists Ask and Answer Questions?

PSYCHOLOGISTS ARM THEIR SCIENTIFIC attitude with the *scientific method*. Psychological science evaluates competing ideas with careful observation and rigorous analysis. In its attempt to describe and explain human nature, it 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

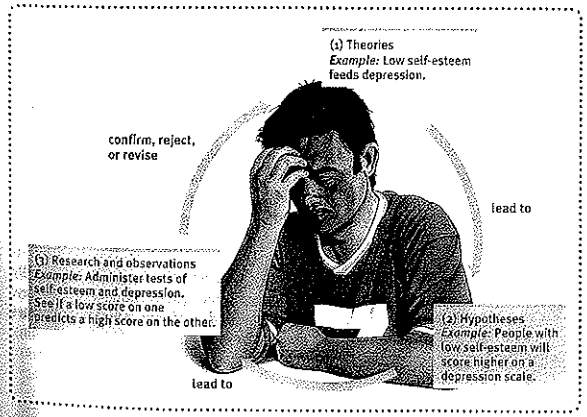
3: How do theories advance psychological science?

In everyday conversation, we often use *theory* to mean "mere hunch." In science, however, theory is linked with observation. A scientific **theory** *explains* through an integrated set of principles that *organizes* observations and *predicts* behaviors or events. By organizing isolated facts, a theory simplifies. There are too many facts about behavior to remember them all. By linking facts and bridging them to deeper principles, a theory offers a useful summary. As we connect the observed dots, a coherent picture emerges.

A good theory of depression, for example, helps us organize countless depression-related observations into a short list of principles. Imagine that we observe over and over that people with depression describe their past, present, and future in gloomy terms. We might therefore theorize that at the heart of depression lies low self-esteem. So far so good: Our self-esteem principle neatly summarizes a long list of facts about people with depression.

Yet no matter how reasonable a theory may sound—and low self-esteem seems a reasonable explanation of depression—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 the theory, such predictions give direction to research. They specify what results would support the theory and what results would disconfirm it. To test our self-esteem theory of depression, we might assess people's self-esteem by having them respond to statements such as "I have good ideas" and "I am fun to be with." Then we could see whether, as we hypothesized, people who report poorer self-images also score higher on a depression scale (FIGURE 2.1).

In testing our theory, we should be aware that it can bias subjective observations. Having theorized that depression springs from low self-esteem, we may see



➤ **FIGURE 2.1**
The scientific method A self-correcting process for asking questions and observing nature's answers.

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

::**hypothesis** a testable prediction, often implied by a theory.

::**operational definition** a statement of the procedures (operations) used to define research variables. For example, *human intelligence* may be operationally defined as what an intelligence test measures.

::**replication** repeating the essence of a research study, usually with different participants in different situations, to see whether the basic finding extends to other participants and circumstances.

::**case study** an observation technique in which one person is studied in depth in the hope of revealing universal principles.

::**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.

◦ **Good theories explain by (1) organizing and linking observed facts, and (2) implying hypotheses that offer testable predictions and, sometimes, practical applications.** ◦

what we expect. We may perceive depressed people's neutral comments as self-disparaging. The urge to see what we expect is an ever-present temptation, in the laboratory and outside of it. Perhaps you are aware of students who, because they have developed an excellent reputation, can now do no wrong in the eyes of teachers. If they're in the hall during class, nobody worries. Other students can do no good. Because they have behaved badly in the past, even their positive behaviors are viewed suspiciously.

As a check on their biases, psychologists report their research with precise **operational definitions** of procedures and concepts. Unlike dictionary definitions, operational definitions describe concepts with precise procedures or measures. *Hunger*, for example, might be defined as "hours without eating," *generosity* as "money contributed." Such carefully worded statements should allow others to **replicate** (repeat) the original observations. If other researchers re-create a study with different participants and materials and get similar results, then our confidence in the finding's reliability grows. The first study of hindsight bias aroused psychologists' curiosity. Now, after many successful replications with differing people and questions, we feel sure of the phenomenon's power.

In the end, our theory will be useful if it (1) effectively *organizes* a range of self-reports and observations, and (2) implies clear *predictions* that anyone can use to check the theory or to derive practical applications. (If we boost people's self-esteem, will their depression lift?) Eventually, our research will probably lead to a revised theory (such as the one in Unit 12) that better organizes and predicts what we know about depression.

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

Description

4: How do psychologists observe and describe behavior?

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

Susan Kuklin/Photo Researchers

▼ **The case of the conversational chimpanzee** In case studies of chimpanzees, psychologists have asked whether language is uniquely human. Here Nim Chimpsky signs *hug* as his trainer, psychologist Herbert Terrace, shows him the puppet Ernie. But is Nim really using language? Psychologists debate that issue.

The Case Study

Among the oldest research methods, the **case study** examines one individual in depth in hopes 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 have revealed their capacity for understanding and language. Intensive case studies are sometimes very revealing.

Case studies often suggest directions for further study, and they show us what can happen. But individual cases may mislead us if the individual being studied is atypical. Unrepresentative information can lead to mistaken judgments and false conclusions. Indeed, anytime a researcher mentions a finding ("Smokers die younger: 95 percent of men over 85 are nonsmokers") someone is sure to offer a contradictory anecdote ("Well, I have an uncle who smoked two packs a day and lived to be 89"). Dramatic stories and personal experiences (even psychological case examples) command our attention, and they are easily remembered. 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."

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.

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

Agatha Christie, *The Tuesday Club Murders*, 1933

The Survey

The **survey** method looks at many cases in less depth. Researchers do surveys when wanting to estimate, from a representative sample of people, the attitudes or reported behaviors of a whole population. Questions about everything from cell-phone use to political opinions are put to the public. Harris and Gallup polls have revealed that 72 percent of Americans think there is too much TV violence, 89 percent favor equal job opportunities for homosexual people, 89 percent are facing high stress, and 96 percent would like to change something about their appearance. In Britain, seven in ten 18- to 29-year-olds recently supported gay marriage; among those over 50, about the same ratio opposed it (a generation gap found in many Western countries). But asking questions is tricky, and the answers often depend on the ways questions are worded and respondents are chosen.

Wording Effects Even subtle changes in the order or wording of questions can have major effects. Should cigarette ads or pornography be allowed on television? People are much more likely to approve "not allowing" such things than "forbidding" or "censoring" them. In one national survey, only 27 percent of Americans approved of "government censorship" of media sex and violence, though 66 percent approved of "more restrictions on what is shown on television" (Lacayo, 1995). People are similarly much more approving of "aid to the needy" than of "welfare," of "affirmative action" than of "preferential treatment," and of "revenue enhancers" than of "taxes." Because wording is such a delicate matter, critical thinkers will reflect on how the phrasing of a question might affect people's expressed opinions.

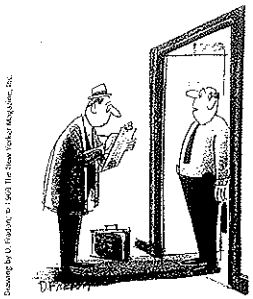
Random Sampling We can describe human experience by drawing on memorable anecdotes and personal experience. But for an accurate picture of a whole population's attitudes and experience, there's only one game in town—the representative sample.

We can extend this point to everyday thinking, as we generalize from samples we observe, especially vivid cases. Given (a) a statistical summary of auto owners' evaluations of their car's make and (b) the vivid comments of two frustrated owners, one's impression may be influenced as much by the two unhappy owners as by the many more evaluations in the statistical summary. The temptation to generalize from a few vivid but unrepresentative cases is nearly irresistible.

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

This Modern World by Tom Tomorrow © 1997

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



Drawing by D. Fradon; © 1969 The New Yorker Magazine, Inc.

"How would you like me to answer that question? As a member of my ethnic group, educational class, income group, or religious category?"

The point to remember: The best basis for generalizing is from a representative sample of cases.

So how do you obtain a representative sample—say, of the students at your high school? How could you choose a group that would represent the total student **population**, the whole group you want to study and describe? Typically, you would choose a **random sample**, in which every person in the entire group has an equal chance of participating. This means you would not send each student a questionnaire. (The conscientious people who return it would not be a random sample.) Rather, you might number the names in the general student listing and then use a random number generator to pick the participants for your survey. 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 Web site polls (think of the voting on shows like *American Idol*)—often merely give misleading results.

The point to remember: Before accepting survey findings, think critically. Consider the sample. You cannot compensate for an unrepresentative sample by simply adding more people.

Naturalistic Observation

A third 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 the school cafeteria.

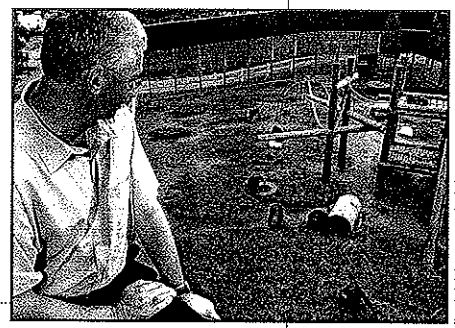


Photo by Rick Kaare, Emory University for Yerkes National Primate Research Center

A natural observer Chimpanzee researcher Frans de Waal (2005) reports that "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." ▲

Like the case study and survey methods, 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," notes chimpanzee observer Jane Goodall (1998). For example, chimpanzees and baboons have been observed using 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. Moreover, the more developed a primate species' brain, the more likely it is that the animals will display deceptive behaviors (Byrne & Corp, 2004).

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

- *A funny finding.* We humans laugh 30 times more often in social situations than in solitary situations. (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 that are 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 electronically activated belt-worn tape recorders. For up to four days, the recorders captured 30 seconds of the students' 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? 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).

Courtesy of Matthias Mehl

An EAR for naturalistic observation Psychologists Matthias Mehl and James Pennebaker have used Electronically Activated Recorders (EAR) to sample naturally occurring slices of daily life. ▲

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. Yet naturalistic observation, like surveys, can provide data for correlational research, which we consider next.

Correlation

5: What are positive and negative correlations, and why do they enable prediction but not cause-effect explanation?

Describing behavior is a first step toward predicting it. Surveys and naturalistic observations 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**) helps us figure how closely two things vary together, and thus how well either one *predicts* the other. Knowing how much aptitude test scores *correlate* with school success tells us how well the scores *predict* school success.

Throughout this book we will often ask how strongly two sets of scores are related: For example, how closely related are the personality scores of identical twins? How well do intelligence test scores predict achievement? How closely is stress related to disease?

FIGURE 2.2, next page, contains three **scatterplots,** illustrating the range of possible correlations from a perfect positive to a perfect negative. (Perfect correlations rarely occur in the "real world.") Each dot in a scatterplot represents the scattered values of two variables. A correlation is positive if two sets of scores, such as height and weight, tend to rise or fall together. Saying that a correlation is "negative" says nothing about its strength or weakness. A correlation is negative if two sets of scores relate inversely, one set going up as the other goes down. Exercise and weight correlate negatively. As exercise goes up from zero, body weight has some tendency to go down. A weak correlation, indicating little relationship, has a coefficient near zero.

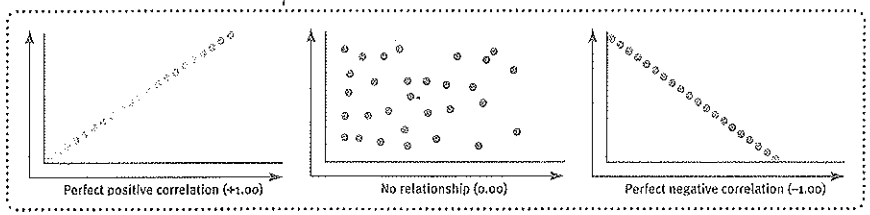
::**random sample** a sample that fairly represents a population because each member has an equal chance of inclusion.

::**naturalistic observation** observing and recording behavior in naturally occurring situations without trying to manipulate and control the situation.

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

::**correlation coefficient** a statistical index of the relationship between two things (from −1 to +1).

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



➤ FIGURE 2.2
Scatterplots, showing patterns of correlation Correlations can range from +1.00 (scores on one measure increase in direct proportion to scores on another) to –1.00 (scores on one measure decrease precisely as scores rise on the other).

Here are four recent news reports of correlational research, some derived from surveys or natural observations. Can you spot which are reporting positive correlations, which negative? (Answers below.)

1. The more young children watch TV, the less they read (Kaiser, 2003).
2. The more sexual content teens see on TV, the more likely they are to have sex (Collins et al., 2004).
3. The longer children are breast-fed, the greater their later academic achievement (Horwood & Fergusson, 1998).
4. The more often adolescents eat breakfast, the lower their body mass (Timlin et al., 2008).

TABLE 2.2

HEIGHT AND TEMPERAMENT OF 20 MEN

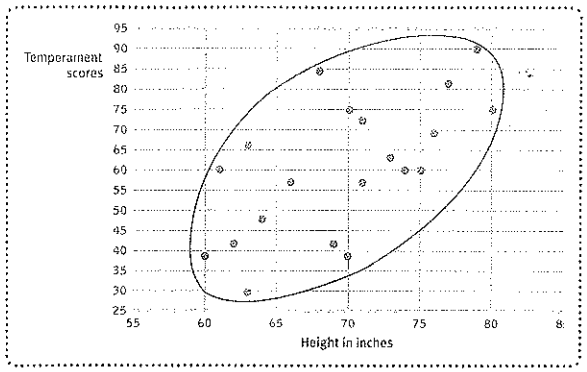
Person	Height in Inches	Temperament
1	80	75
2	63	66
3	61	60
4	79	90
5	74	60
6	69	42
7	62	42
8	75	60
9	77	81
10	60	39
11	64	48
12	76	69
13	71	72
14	66	57
15	73	63
16	70	75
17	63	30
18	71	57
19	68	84
20	70	39

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

With all the relevant data (TABLE 2.2) right in front of you, can you tell whether there is (1) a positive correlation between height and reactive temperament, (2) very little or no correlation, or (3) a negative correlation?

Comparing the columns in Table 2.2, most people detect very little relationship between height and temperament. In fact, the correlation in this imaginary example is moderately positive, +0.63, as we can see if we display the data as a scatterplot. In FIGURE 2.3, moving from left to right, the upward, oval-shaped slope of the cluster of points shows that our two imaginary sets of scores (height and reactivity) tend to rise together.

◦ Answers to correlation question: 1. negative, 2. positive, 3. positive, 4. negative. ◦



➤ FIGURE 2.3
Scatterplot for height and temperament This display of data from 20 imagined men (each represented by a data point) reveals an upward slope, indicating a positive correlation. The considerable scatter of the data indicates the correlation is much lower than +1.0.

If we fail to see a relationship when data are presented as systematically as in Table 2.2, how much less likely are we to notice them in everyday life? To see what is right in front of us, we sometimes need statistical illumination. We can easily see evidence of gender discrimination when given statistically summarized information about job level, seniority, performance, gender, and salary. But we often see no discrimination when the same information dribbles in, case by case (Twiss et al., 1989).

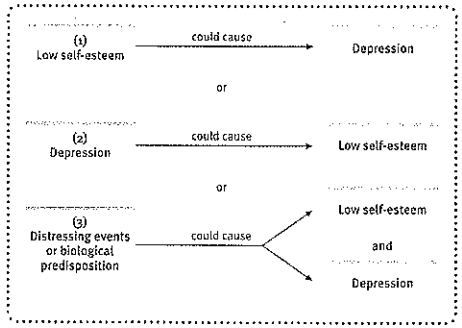
The point to remember: A correlation coefficient, which can range from –1.0 to +1.0, reveals the extent to which two things relate.

Correlation and Causation

Correlations help us predict. Low self-esteem correlates with (and therefore predicts) depression. (This correlation might be indicated by a correlation coefficient, or just by a finding that people who score on the lower half of a self-esteem scale have an elevated depression rate.) 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 *prove* anything!

As options 2 and 3 in FIGURE 2.4 show, we'd get the same negative correlation between low self-esteem and depression if depression caused people to be down on themselves, or if some third factor—such as heredity or brain chemistry—caused both low self-esteem and depression. Among men, for example, length of marriage correlates positively with hair loss—because both are associated with a third factor, age.

This point is so important—so basic to thinking smarter with psychology—that it merits one more example, from a survey of more than 12,000 adolescents. The study 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 behavior right through the high school years," gushed an Associated



➤ FIGURE 2.4
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.

© Cleveland Clinic LLC/Getty

Correlation need not mean causation Length of marriage correlates with hair loss in men. Does this mean that marriage causes men to lose their hair (or that balding men make better husbands)? In this case, as in many others, a third factor obviously explains the correlation: Golden anniversaries and baldness both accompany aging. ▲

◦ A study reported in the *British Medical Journal* found that youths who identify with the goth subculture attempt, more often than other young people, to harm or kill themselves (Young et al., 2006). Can you imagine multiple possible explanations for this association? •

Press (AP) story reporting the finding. But this correlation comes with no built-in cause-effect arrow. Said differently (turn the volume up here), *association does not prove causation.*[2] Thus, 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 jerks."

The point to remember: Correlation indicates the *possibility* of a cause-effect relationship, *but it does not prove causation.* Knowing that two events are associated need not tell us anything about causation. Remember this principle and you will be wiser as you read and hear news of scientific studies.

Illusory Correlations

6: What are illusory correlations?

Correlation coefficients make visible the relationships we might otherwise miss. They also restrain our "seeing" relationships that actually do not exist. A perceived but nonexistent correlation is an **illusory correlation.** When we *believe* there is a relationship between two things, we are likely to *notice* and *recall* instances that confirm our belief (Trolier & Hamilton, 1986).

Because we are sensitive to dramatic or unusual events, we are especially likely to notice and remember the occurrence of two such events in sequence—say, a premonition of an unlikely phone call followed by the call. When the call does not follow the premonition, we are less likely to note and remember the nonevent. Illusory correlations help explain many superstitious beliefs, such as the presumption that infertile couples who adopt become more likely to conceive (Gilovich, 1991). Couples who conceive after adopting capture our attention. We're less likely to notice those who adopt and never conceive, or those who conceive without adopting. In other words, illusory correlations occur when we over-rely on the top left cell of FIGURE 2.5, ignoring equally essential information in the other cells.

Such illusory thinking helps explain why for so many years people believed (and many still do) that sugar makes children hyperactive, that getting chilled and wet causes people to catch a cold, and that changes in the weather trigger arthritis pain. We are, it seems, prone to perceiving patterns, whether they're there or not.

The point to remember: When we notice random coincidences, we may forget that they are random and instead see them as correlated. Thus, we can easily deceive ourselves by seeing what is not there.

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 look for order even in random data. And we usually find it, because—

	Conceive	Do not conceive
Adopt	confirming evidence	disconfirming evidence
Do not adopt	disconfirming evidence	confirming evidence

Michael Newman/PhotoEdit

➤ FIGURE 2.5
Illusory correlation in everyday life Many people believe infertile couples become more likely to conceive a child after adopting a baby. This belief arises from their attention being drawn to such cases. The many couples who adopt without conceiving or conceive without adopting grab less attention. To determine whether there actually is a correlation between adoption and conception, we need data from all four cells in this figure. (From Gilovich, 1991.)

[2]Because many associations are stated as correlations, the famously worded principle is "Correlation does not prove causation." That's true, but it's also true of associations verified by other nonexperimental statistics (Hatfield et al., 2006).

here's a curious fact of life—*random sequences often don't look random.* Consider a random coin flip: If someone flipped a coin six times, which of the following sequences of heads (H) and tails (T) would be most likely: HHHTTT or HTTHTH or HHHHHH?

Daniel Kahneman and Amos Tversky (1972) found that most people believe HTTHTH would be the most likely random sequence. Actually, all three are equally likely (or, you might say, equally unlikely). A poker hand of 10 through ace, all of hearts, would seem extraordinary; actually, it would be no more or less likely than any other specific hand of cards (FIGURE 2.6).

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

1. H	11. T	21. T	31. T	41. H	51. T
2. T	12. H	22. T	32. T	42. H	
3. T	13. H	23. H	33. T	43. H	
4. T	14. T	24. T	34. T	44. H	
5. H	15. T	25. T	35. T	45. T	
6. H	16. H	26. T	36. H	46. H	
7. H	17. T	27. H	37. T	47. H	
8. T	18. T	28. T	38. T	48. T	
9. T	19. H	29. H	39. H	49. T	
10. T	20. H	30. T	40. T	50. T	

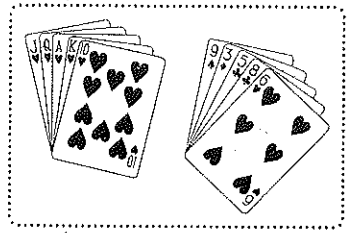
Looking over the sequence, patterns jump out: Tosses 10 to 22 provided an almost perfect pattern of pairs of tails followed by pairs of heads. On tosses 30 to 38 I had a "cold hand," with only one head in eight tosses. But my fortunes immediately reversed with a "hot hand"—seven heads out of the next 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, 1989, 1995; Myers, 2002). These sequences often don't look random, and so get 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, 24 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 (as applies to our coin tosses). 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 two New Jersey lotteries will win both times. But statisticians Stephen Samuels and George McCabe (1989) reported that, given the millions of people who buy U.S. state lottery tickets, 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 six times a day, 2000 times a year.

::illusory correlation the perception of a relationship where none exists.

◦ 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). ◦



➤ FIGURE 2.6
Two random sequences Your chances of being dealt either of these hands are precisely the same: 1 in 2,598,960.

◦ On March 11, 1998, Utah's Ernie and Lynn Carey gained three new grandchildren when three of their daughters gave birth—on the same day (*Los Angeles Times,* 1998). ◦

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

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

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

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

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

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

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

::**independent variable** the experimental factor that is manipulated; the variable whose effect is being studied.

::**confounding variable** a factor other than the independent variable that might produce an effect in an experiment.

::**dependent variable** the outcome factor; the variable that may change in response to manipulations of the independent variable.

Experimentation

?: How do experiments, powered by random assignment, clarify cause and effect?

Happy are they, remarked the Roman poet Virgil, "who have been able to perceive the causes of things." To isolate cause and effect, psychologists can statistically control for other factors. For example, researchers have found that breast-fed infants grow up with somewhat higher intelligence scores than do infants bottle-fed with cow's milk (Angelsen et al., 2001; Mortensen et al., 2002; Quinn et al., 2001). They have also found that breast-fed British babies have 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).

So, does this mean that 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 help answer this question, researchers have "controlled for" (statistically removed differences in) certain other factors, such as maternal age, education, and income. And they have found that in infant nutrition, mother's milk correlates modestly but positively with later intelligence.

Correlational research cannot control for all possible factors. But researchers can isolate cause and effect with an **experiment**. Experiments enable a researcher to focus on the possible effects of one or more factors by (1) *manipulating the factors of interest* and (2) *holding constant ("controlling") other factors*. With parental permission, a British research team *randomly assigned* 424 hospital preterm infants either to standard infant formula feedings or to donated breast milk feedings (Lucas et al., 1992). On intelligence tests taken at age 8, the children nourished with breast milk had significantly higher intelligence scores than their formula-fed counterparts. Earlier we mentioned the place of *random sampling* in a well-done survey. Consider now the equally important place of *random assignment* in a well-done experiment.

Random Assignment

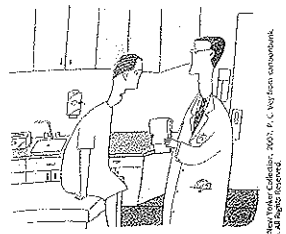
No single experiment is conclusive, of course. But by **randomly assigning** infants to one feeding group or the other, researchers were able to hold constant all factors except nutrition. This eliminated alternative explanations and supported the conclusion that breast is indeed best for developing intelligence (at least for preterm infants).

If a behavior (such as test performance) changes when we vary an experimental factor (such as infant nutrition), then we infer 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, too, how we might assess a therapeutic intervention. 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. If, after nearly failing the first test, we listen to a "peak learning" subliminal CD and then improve on the next test, we may credit the CD rather than conclude that our performance has returned to our average. In the 1700s, bloodletting *seemed* effective. Sometimes people improved after the treatment; when they didn't, the practitioner inferred the disease was just too advanced to be reversed. (We, of course, now know that usually bloodletting is a *bad* treatment.) So, whether or not a remedy is truly effective, enthusiastic users will probably endorse it. To find out whether it actually is effective, we must experiment.

And that is precisely how investigators evaluate new drug treatments and new methods of psychological therapy (Unit 13). The participants in these studies are randomly assigned to the research groups and are often *blind* (uninformed) about what treatment, if any, they are receiving. One group receives a treatment (such as medication or other therapy). The other group receives a pseudotreatment--an inert *placebo* (perhaps a pill with no drug in it). If the study is using a **double-blind procedure**, neither the participants nor the research assistants collecting 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' belief in its healing powers and the staff's enthusiasm for its potential. 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 & Sapirstein, 1998). 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.

The double-blind procedure is one way to create an **experimental group**, in which people receive the treatment, and a contrasting **control group** that does not receive the treatment. By randomly assigning people to these conditions, researchers can be fairly certain the two groups are otherwise identical. Random assignment roughly equalizes the two groups in age, attitudes, and every other characteristic. With random assignment, as occurred with the infants in the breast milk experiment, we also can conclude that any later differences between people in the experimental and control groups will usually be the result of the treatment.



The New Yorker Collection, 2001 P. C. Vey from cartoonbank.com. All Rights Reserved.

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

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 who gave them the pills knew which drug 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.

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 can potentially influence the results of the experiment, 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 (the precise drug dosage and timing in this study) 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 2.7, next page, 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 a rental house, Adrian Carpusor and William Loges (2006) sent identically worded e-mail inquiries to 1115 Los Angeles-area landlords. The researchers varied the ethnic connotation of the sender's name and tracked the percentage of positive replies (invitations to view the apartment in person). "Patrick McDougall," "Said Al-Rahman," and "Tyrell Jackson"

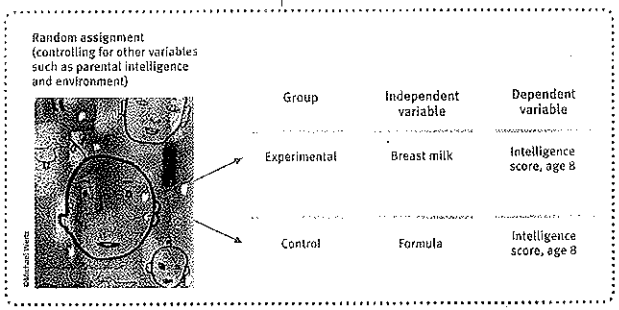
» Note the distinction between random sampling in surveys (discussed earlier in relation to surveys) and random assignment in experiments (depicted in Figure 2.7). *Random sampling* helps us generalize to a larger population. *Random assignment* controls extraneous influences, which helps us infer cause and effect «

received, respectively, 89 percent, 66 percent, and 56 percent invitations. In this experiment, what was the independent variable? The dependent variable?[3]

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 groups: an *experimental group* and a *comparison* or *control group*. *Random assignment* works to equate the groups before any treatment effects. 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 2.3 compares the features of psychology's research methods.



➢ FIGURE 2.7
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 (type of milk).

TABLE 2.3

COMPARING RESEARCH METHODS

Research Method	Basic Purpose	How Conducted	What Is Manipulated	Strengths	Weaknesses
Descriptive	To observe and record behavior	Case studies, surveys, or naturalistic observations	Nothing	Case studies require only one participant; surveys may be done fairly quickly and inexpensively (compared to experiments); naturalistic observations may be done when it is not ethical to manipulate variables.	No control of variables; single cases may be misleading
Correlational	To detect naturally occurring relationships; to assess how well one variable predicts another	Compute statistical association, sometimes among survey responses	Nothing	Works with large groups of data, and may be used in situations where an experiment would not be ethical or possible	Does not specify cause and effect
Experimental	To explore cause and effect	Manipulate one or more factors; use random assignment	The independent variable(s)	Specifies cause and effect, and variables are controlled	Sometimes not feasible; results may not generalize to other contexts; not ethical to manipulate certain variables

[3]The independent variable, which the researchers manipulated, was the ethnicity-related names. The dependent variable, which they measured, was the positive response rate.

BEFORE YOU MOVE ON . . .

➢ **ASK YOURSELF**

If you were to become a research psychologist, what questions would you like to explore with experiments?

➢ **TEST YOURSELF 2**

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

Answers to the Test Yourself questions can be found in Appendix E at the end of the book.

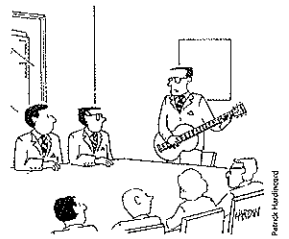
Statistical Reasoning in Everyday Life

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

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

- *Ten percent of people are lesbians or gay men.* Or is it 2 to 3 percent, as suggested by various national surveys (Unit 8A)?
- *We ordinarily use but 10 percent of our brain.* Or is it closer to 100 percent (Unit 3B)?
- *The human brain has 100 billion nerve cells.* Or is it more like 40 billion, as suggested by extrapolation from sample counts (Unit 3A)?

The point to remember: Doubt big, round, undocumented numbers. Rather than swallowing top-of-the-head estimates, focus on thinking smarter by applying simple statistical principles to everyday reasoning.



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

Describing Data

8: How can we describe data with measures of central tendency and variation?

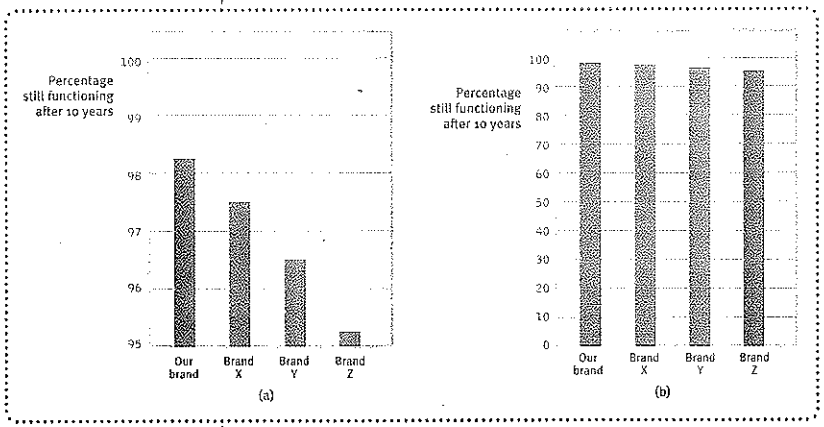
Once researchers have gathered their data, they must organize them in some meaningful way. One way to do this is to convert the data into a simple *bar graph*, as in FIGURE 2.8, next page, which displays a distribution of different brands of trucks still on the road after a decade. When reading statistical graphs such as this, take care. It's easy to design a graph to make a difference look big (Figure 2.8a) or small (Figure 2.8b). The secret lies in how you label the vertical scale (the Y-axis).

The point to remember: Think smart. When viewing figures in magazines and on television, read the scale labels and note their range.

Measures of Central Tendency

The next step is to summarize the data using some *measure of central tendency*, a single score that represents a whole set of scores. The simplest measure is the **mode**, the most

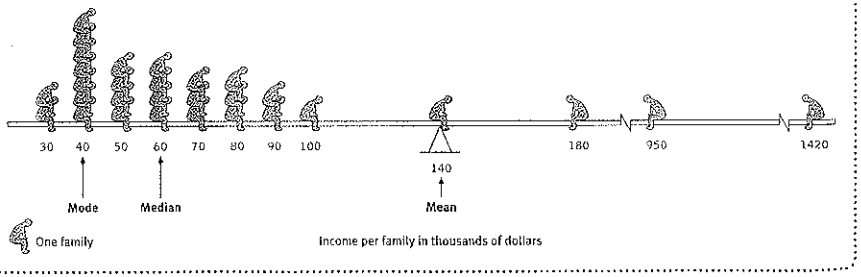
::mode the most frequently occurring score(s) in a distribution.



➤ FIGURE 2.8
Read the scale labels An American truck manufacturer offered graph (a)—with actual brand names included—to suggest the much greater durability of its trucks. Note, however, how the apparent difference shrinks as the vertical scale changes in graph (b).

frequently occurring score or scores. The most commonly reported is the **mean**, or arithmetic average—the sum of all the scores divided by the number of scores. On a divided highway, the median is the middle. So, too, with data: The **median** is the midpoint—the 50th percentile. If you arrange all the scores in order from the highest to the lowest, half will be above the median and half will be below it. In a symmetrical bell-shaped distribution of scores, the mode, mean, and median scores may be the same or very similar.

Measures of central tendency neatly summarize data. But consider what happens to the mean when a distribution is lopsided or *skewed*. With income data, for example, the mode, median, and mean often tell very different stories (FIGURE 2.9). This happens because the mean is biased by a few extreme scores. When Microsoft co-founder Bill Gates sits down in an intimate café, its average (mean) customer instantly becomes a billionaire. But the customer's median wealth remains unchanged. Understanding this, you can see how a British newspaper could accurately run the headline "Income for 62% Is Below Average" (Waterhouse, 1993). Because the bottom *half* of British income earners receive only a *quarter* of the national income cake, most British people, like most people everywhere, make less than the mean. In the United States, Republicans



➤ FIGURE 2.9
A skewed distribution This graphic representation of the distribution of a village's incomes illustrates the three measures of central tendency—mode, median, and mean. Note how just a few high incomes make the mean—the fulcrum point that balances the incomes above and below—deceptively high.

have tended to tout the economy's solid growth since 2000 using average income; Democrats have lamented the economy's lackluster growth using median income (Paulos, 2006). Mean and median tell different true stories.

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

Measures of Variation

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

The **range** of scores—the gap between the lowest and highest scores—provides only a crude estimate of variation because a couple of extreme scores in an otherwise uniform group, such as the $950,000 and $1,420,000 incomes in Figure 2.9, will create a deceptively large range.

The more useful standard for measuring how much scores deviate from one another is the **standard deviation**. It better gauges whether scores are packed together or dispersed, because it uses information from each score (TABLE 2.4). The computation assembles information about how much individual scores differ from the mean. If your high school serves a community where most families have similar incomes, family income data will have a relatively small standard deviation compared with a school in a more diverse community population.

The average person has one ovary and one testicle.

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

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

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

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

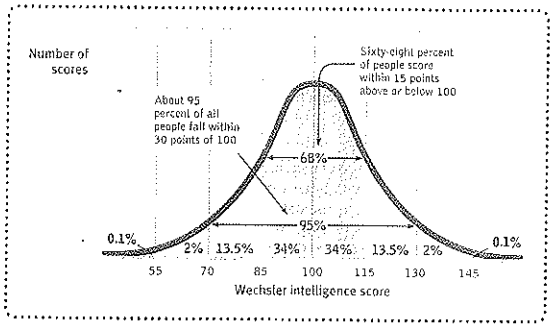
TABLE 2.4

STANDARD DEVIATION IS MUCH MORE INFORMATIVE THAN MEAN ALONE

Note that the test scores in Class A and Class B have the same mean (80), but very different standard deviations, which tell us more about how the students in each class are really faring.

Test Scores in Class A			Test Scores in Class B		
Score	**Deviation from the Mean**	**Squared Deviation**	**Score**	**Deviation from the Mean**	**Squared Deviation**
72	-8	64	60	-20	400
74	-6	36	60	-20	400
77	-3	9	70	-10	100
79	-1	1	70	-10	100
82	+2	4	90	+10	100
84	+4	16	90	+10	100
85	+5	25	100	+2-	400
87	+7	49	100	+20	400
Total = 640		Sum of (deviations)² = 204	Total = 640		Sum of (deviations)² = 2000
Mean = 640 ÷ 8 = 80			Mean = 640 ÷ 8 = 80		
Standard deviation = $\sqrt{\frac{\text{Sum of (deviations)}^2}{\text{Number of scores}}} = \sqrt{\frac{204}{8}} = 5.0$			Standard deviation = $\sqrt{\frac{\text{Sum of (deviations)}^2}{\text{Number of scores}}} = \sqrt{\frac{2000}{8}} = 15.8$		

➢ FIGURE 2.10
The normal curve Scores on aptitude tests tend to form a normal, or bell-shaped, curve. For example, the Wechsler Adult Intelligence Scale calls the average score 100.



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

As FIGURE 2.10 shows, a useful property of the normal curve is that roughly 68 percent of the cases fall within one standard deviation on either side of the mean. About 95 percent of cases fall within two standard deviations. Thus, Unit 11 notes that about 68 percent of people taking an intelligence test will score within ±15 points of 100. About 95 percent will score within ±30 points.

Making Inferences

9: What principles can guide our making generalizations from samples and deciding whether differences are significant?

Data are "noisy." The average score in one group (breast-fed babies) could conceivably differ from the average score in another group (formula-fed babies) not because of any real difference but merely because of chance fluctuations in the people sampled. How confidently, then, can we infer that an observed difference accurately estimates the true difference? For guidance, we can ask how reliable and significant the differences are.

When Is an Observed Difference Reliable?

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

1. **Representative samples are better than biased samples.** The best basis for generalizing is not from the exceptional and memorable cases one finds at the extremes but from a representative sample of cases. Research never randomly samples the whole human population. Thus, it pays to keep in mind what population a study has sampled.
2. **Less-variable observations are more reliable than those that are more variable.** As we noted in the example of the basketball player whose game-to-game points were consistent, an average is more reliable when it comes from scores with low variability.

3. **More cases are better than fewer.** An eager high school senior visits two university campuses, each for a day. At the first, the student randomly attends two classes and discovers both instructors to be witty and engaging. At the next campus, the two sampled instructors seem dull and uninspiring. Returning home, the student (discounting the small sample size of only two teachers at each institution) tells friends about the "great teachers" at the first school, and the "bores" at the second. Again, we know it but we ignore it: *Averages based on many cases are more reliable* (less variable) than averages based on only a few cases.

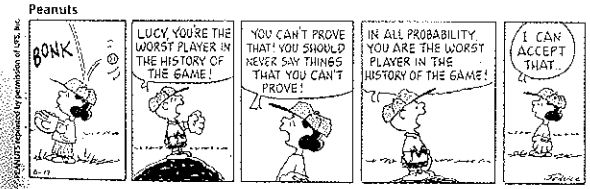
The point to remember: Don't be overly impressed by a few anecdotes. Generalizations based on a few unrepresentative cases are unreliable.

When Is a Difference Significant?

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

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

In judging statistical significance, psychologists are conservative. They are like juries who must presume innocence until guilt is proven. For most psychologists, proof beyond a reasonable doubt means not making much of a finding unless the odds of its occurring by chance are less than 5 percent (an arbitrary criterion).



When reading about research, you should remember that, given large enough or homogeneous enough samples, a difference between them may be "statistically significant" yet have little practical significance. For example, comparisons of intelligence test scores among hundreds of thousands of first-born and later-born individuals indicate a highly significant tendency for first-born individuals to have higher average scores than their later-born siblings (Kristensen & Bjerkedal, 2007; Zajonc & Markus, 1975). But because the scores differ by only one to three points, the difference has little practical importance. Such findings have caused some psychologists to advocate alternatives to significance testing (Hunter, 1997). Better, they say, to use other ways to express a finding's *effect size*—its magnitude and reliability.

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

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

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

BEFORE YOU MOVE ON . . .

➢ ASK YOURSELF

Find a graph in a popular magazine ad. How does the advertiser use (or abuse) statistics to make a point?

➢ TEST YOURSELF 3

Consider a question posed by Christopher Jepson, David Krantz, and Richard Nisbett (1983) to University of Michigan introductory psychology students:

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

Answers to the Test Yourself questions can be found in Appendix E at the end of the book.

Frequently Asked Questions About Psychology

WE HAVE REFLECTED ON HOW A scientific approach can restrain biases. We have seen how case studies, surveys, and naturalistic observations 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. And we have considered how statistical tools can help us see and interpret the world around us.

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.

Psychology Applied

10: 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 have anything useful to say 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 they have refined through many experiments. Similarly, it is the principles of the visual system, developed from experiments in artificial settings (such as looking at red lights in the dark), that we apply to more complex behaviors such as night flying. And many investigations show that principles derived in the laboratory do typically generalize to the everyday world (Anderson et al., 1999).

The point to remember: Psychologists' concerns lie less with unique behaviors than with discovering general principles that help explain many behaviors.

11: Does behavior depend on one's culture and gender?

What can psychological studies done in one time and place, often with White Europeans or North Americans, really tell us about people in general? As we will see time and again, **culture**—shared ideas and behaviors that one generation passes on to the next—matters. Our culture shapes our behavior. It influences our standards of promptness and frankness, our attitudes toward premarital sex and varying body shapes, our tendency to be casual or formal, our willingness to make eye contact, our conversational distance, and much, much more. Being aware of such differences, we can restrain our assumptions that others will think and act as we do. 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).

The point to remember: 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, 1990). 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.

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

Adam Berg/ Kamy

Soccer shoes? Because culture shapes social behavior, actions that seem ordinary to others may seem odd to us. Yet underlying these differences are powerful similarities. Children everywhere love to play sports such as soccer. But most U.S. children would play with athletic shoes on grass, not barefoot on the street, as with these Burkina Faso boys. ▲

"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

"I believe that to prevent, cripple, or needlessly complicate the research that can relieve animal and human suffering is profoundly inhuman, cruel, and immoral."
Psychologist Neal Miller, 1983

"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 righteous know the needs of their animals."
Proverbs 12:10

Ethics in Research

12: Why do psychologists study animals, and is it ethical to experiment on animals?

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, by doing experiments permissible only with animals. Human physiology resembles that of many other animals. We humans are not *like* animals; we are animals. Animal experiments have therefore led to treatments for human diseases—insulin for diabetes, vaccines to prevent polio and rabies, transplants to replace defective organs.

Likewise, the same processes by which humans see, exhibit emotion, and become obese are present in rats and monkeys. To discover more about the basics of human learning, researchers even study sea slugs. To understand how a combustion engine works, you would do better to study a lawn mower's engine than a Mercedes'. Like Mercedes engines, human nervous systems are complex. But the simplicity of the sea slug's nervous system is precisely what makes it so revealing of the neural mechanisms of learning.

If we share important similarities with other animals, then should we not respect them? "We cannot defend our scientific work with animals on the basis of the similarities between them and ourselves and then defend it morally on the basis of differences," noted Roger Ulrich (1991). The animal protection movement protests the use of animals in psychological, biological, and medical research. Researchers remind us that the animals used worldwide each year in research are but a fraction of 1 percent of the billions of animals killed annually for food. And yearly, for every dog or cat used in an experiment and cared for under humane regulations, 50 others are killed in humane animal shelters (Goodwin & Morrison, 1999).

Some animal protection organizations want to replace experiments on animals with naturalistic observation. Many animal researchers respond that this is not a question of good versus evil but of compassion for animals versus compassion for people. How many of us would have attacked Louis Pasteur's experiments with rabies, which caused some dogs to suffer but led to a vaccine that spared millions of people (and dogs) from agonizing death? And would we really wish to have deprived ourselves of the animal research that led to effective methods of training children with mental disorders; of understanding aging; and of relieving fears and depression? The answers to such questions vary by culture. In Gallup surveys in Canada and the United States, about 60 percent of adults deem medical testing on animals "morally acceptable." In Britain, only 37 percent do (Mason, 2003).

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? Defenders of research on animals argue that anyone who has eaten a hamburger, worn leather shoes, tolerated hunting and fishing, or supported the extermination of crop-destroying or plague-carrying pests has already agreed that, yes, it is sometimes permissible to sacrifice animals for the sake of human well-being.

Scott Plous (1993) notes, however, that our compassion for animals varies, as does our compassion for people—based on their perceived similarity to us. As Unit 14 explains, we feel more attraction, give more help, and act less aggressively toward similar others. Likewise, we value animals according to their perceived kinship with us. Thus, primates and companion pets get top priority. (Western people raise or trap mink and foxes for their fur, but not dogs or cats.) Other mammals occupy the second rung on the privilege ladder, followed by birds, fish, and reptiles on the third rung, with insects at the bottom. In deciding which animals have rights, we each draw our own cut-off line somewhere across the animal kingdom.

If we give human life first priority, the second issue is the priority we give to the well-being of animals in research. What safeguards should protect them? Most researchers today feel ethically obligated to enhance the well-being of captive animals and protect them from needless suffering. In one survey of animal researchers, 98 percent or more 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. For example, British Psychological Society guidelines call for housing animals under reasonably natural living conditions, with companions for social animals (Lea, 2000). American Psychological Association (2002) guidelines mandate ensuring the "comfort, health, and humane treatment" of animals, and of minimizing "infection, illness, and pain of animal subjects." Humane care also leads to more effective science, because pain and stress would distort the animals' behavior during experiments.

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). In New York, formerly listless and idle Bronx Zoo animals now stave off boredom by working for their supper, as they would in the wild (Stewart, 2002). 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.

13: Is it ethical to experiment on people?

If the image of researchers delivering supposed electric shocks troubles you, you may be relieved to know that in most psychological studies, especially those with human participants, blinking lights, flashing words, and pleasant social interactions are more common.

Occasionally, though, researchers do temporarily stress or deceive people—though more mildly than the stresses that people sometimes willingly undergo in network reality TV programs. But stress and deception are used sparingly—only when researchers believe it is essential to a justifiable end, such as understanding and controlling violent behavior or studying mood swings. Such experiments wouldn't work if the participants knew all there was to know about the experiment beforehand. Wanting to be helpful, the participants might try to confirm the researcher's predictions.

Ethical principles developed by the American Psychological Association (1992), by the British Psychological Society (1993), and by psychologists internationally (Pettifor, 2004), urge investigators to (1) obtain the **informed consent** of potential participants, (2) protect them from harm and discomfort, (3) treat information about individual participants confidentially, and (4) fully **debrief** people: explain the research afterward. Moreover, most universities (where a great deal of research is conducted) now screen research proposals through an ethics committee—an "Institutional Review Board"—that safeguards the well-being of every participant.

The ideal is for a researcher to be sufficiently informative *and* considerate so that participants will leave feeling at least as good about themselves as when they came in. Better yet, they should be repaid by having learned something. If treated respectfully, most participants enjoy or accept their engagement (Epley & Huff, 1998; Kimmel, 1998). Indeed, say psychology's defenders, teachers provoke much greater anxiety by giving and returning class tests than do researchers in a typical experiment.

Much research occurs outside of university laboratories, in places where there may be no ethics committees. For example, retail stores routinely survey people, photograph their purchasing behavior, track their buying patterns, and test the effectiveness of advertising. Curiously, such research attracts less attention than the scientific research done to advance human understanding.

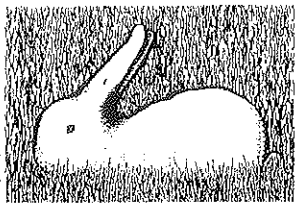
"The greatness of a nation can be judged by the way its animals are treated."
Mahatma Gandhi, 1869–1948

Ken Vidkar/Getty Images

Animal research benefiting animals Thanks partly to research on the benefits of novelty, control, and stimulation, these gorillas are enjoying an improved quality of life in New York's Bronx Zoo.

informed consent an ethical principle that research participants be told enough to enable them to choose whether they wish to participate.

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



© Roger Shepard

➤ FIGURE 2.11

What do you see? People interpret ambiguous information to fit their preconceptions. Do you see a duck or a rabbit? Before showing some friends this image, ask them if they can see the duck lying on its back (or the bunny in the grass). (From Shepard, 1990.)

"It is doubtless impossible to approach any human problem with a mind free from bias."

Simone de Beauvoir, *The Second Sex*, 1953

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 2.11).

Even the words we use to describe something can reflect our values. Are the sex acts that an individual does not practice "perversions" or "sexual variations"? Both in and out of psychology, labels describe and labels evaluate: The same holds true in everyday speech. One person's "rigidity" is another's "consistency." One person's "faith" is another's "fanaticism." Our labeling someone as "firm" or "stubborn," "careful" or "picky," "discreet" or "secretive" reveals our feelings.

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 certainly help us reach our goals, but it cannot decide what those goals should be.

If some people see psychology as merely common sense, others have a different concern—that it is becoming dangerously powerful. Is it an accident that astronomy is the oldest science and psychology the youngest? To some people, 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 our world's great problems—war, overpopulation, prejudice, family crises, crime—all of which involve attitudes and behaviors. Psychology also speaks to our deepest longings—for nourishment, for love, for happiness. Psychology cannot address all of life's great questions, but it speaks to some mighty important ones.

Office of Public Affairs at Columbia University

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

BEFORE YOU MOVE ON . . .

➤ ASK YOURSELF

Were any of the Frequently Asked Questions your questions? Do you have other questions or concerns about psychology?

➤ TEST YOURSELF 4

How are human and animal research subjects protected?

Answers to the Test Yourself questions can be found in Appendix E at the end of the book.

UNIT REVIEW: Research Methods: Thinking Critically With Psychological Science

The Need for Psychological Science

1: Why are the answers that flow from the scientific approach more reliable than those based on intuition and common sense?

Although common sense often serves us well, we are prone to *hindsight bias* (also called the "I-knew-it-all-along phenomenon"), the tendency to believe, after learning an outcome, that we would have foreseen it. We also are routinely overconfident of our judgments, thanks partly to our bias to seek information that confirms them. Although limited by the testable questions it can address, scientific inquiry can help us sift reality from illusion and restrain the biases of our unaided intuition.

2: What are three main components of the scientific attitude?

The three components of the scientific attitude are (1) a curious eagerness to (2) skeptically scrutinize competing ideas and (3) an open-minded humility before nature. This attitude carries into everyday life as *critical thinking*, which examines assumptions, discerns hidden values, evaluates evidence, and assesses outcomes. Putting ideas, even crazy-sounding ideas, to the test helps us winnow sense from nonsense.

How Do Psychologists Ask and Answer Questions?

3: How do theories advance psychological science?

Psychological *theories* organize observations and imply predictive *hypotheses*. After constructing precise *operational definitions* of their procedures, researchers test their hypotheses, validate and refine the theory, and, sometimes, suggest practical applications. If other researchers can *replicate* the study with similar results, we can then place greater confidence in the conclusion.

4: How do psychologists observe and describe behavior?

Psychologists observe and describe behavior using individual *case studies*, *surveys* among *random samples* of a *population*, and *naturalistic observations*. In generalizing from observations, remember: Representative samples are a better guide than vivid anecdotes.

5: What are positive and negative correlations, and why do they enable prediction but not cause-effect explanation?

Scatterplots help us to see *correlations*. A positive correlation (ranging from 0 to +1.00) indicates the extent to which two factors rise together. In a negative correlation (ranging from 0 to −1.00), one item rises as the other falls. An association (sometimes stated as a *correlation coefficient*) indicates the possibility of a cause-effect relationship, but it does not prove the direction of the influence, or whether an underlying third factor may explain the correlation.

6: What are illusory correlations?

Illusory correlations are random events that we notice and falsely assume are related. Patterns or sequences occur naturally in sets of random data, but we tend to interpret these patterns as meaningful connections, perhaps in an attempt to make sense of the world around us.

7: How do experiments, powered by random assignment, clarify cause and effect?

To discover cause-effect relationships, psychologists conduct *experiments*, manipulating one or more factors of interest and controlling other *confounding variables*. *Random assignment* minimizes preexisting differences between the *experimental group* (exposed to the treatment) and the *control group* (given a placebo or different version of the treatment). The *independent variable* is the factor you manipulate to study its effect. The *dependent variable* is the factor you measure to discover any changes that occur in response to these manipulations. Studies may use a *double-blind procedure* to avoid the *placebo effect* and researcher's bias.

Statistical Reasoning in Everyday Life

8: How can we describe data with measures of central tendency and variation?

Three measures of central tendency are the *median* (the middle score in a group of data), the *mode* (the most frequently occurring score), and the *mean* (the arithmetic average). Measures of variation tell us how similar or diverse data are. A *range* describes the gap between the highest and lowest scores. The more useful measure, the *standard deviation*, states how much scores vary around the mean, or average, score. The *normal curve* is a bell-shaped curve that describes the distribution of many types of data.

9: What principles can guide our making generalizations from samples and deciding whether differences are significant?

Three principles are worth remembering: (1) Representative samples are better than biased samples. (2) Less-variable observations are more reliable than those that are more variable. (3) More cases are better than fewer.

When averages from two samples are each reliable measures of their own populations, and the difference between them is relatively large, we can assume that the result is *statistically significant*—that it did not occur by chance alone.

Frequently Asked Questions About Psychology

10: Can laboratory experiments illuminate everyday life?

By intentionally creating a controlled, artificial environment in the lab, researchers aim to test theoretical principles. These general principles help explain everyday behaviors.

11: Does behavior depend on one's culture and gender?

Attitudes and behaviors vary across *cultures*, but the underlying principles vary much less because of our human kinship. Although gender differences tend to capture attention, it is important to remember our greater gender similarities.

12: Why do psychologists study animals, and is it ethical to experiment on animals?
Some psychologists are primarily interested in animal behavior. Others study animals to better understand the physiological and psychological processes shared by humans. Under ethical and legal guidelines, animals used in experiments rarely experience pain. Nevertheless, animal rights groups raise an important issue: Even if it leads to the relief of human suffering, is an animal's temporary suffering justified?

13: Is it ethical to experiment on people?
Researchers may temporarily stress or deceive people in order to learn something important. However, animal protection legislation, laboratory regulation and inspection, and local ethics committees serve to protect human and animal welfare. At universities, Institutional Review Boards screen research proposals. Ethical principles developed by international psychological organizations urge researchers using human participants to obtain *informed consent*, to protect them from harm and discomfort, to treat their personal information confidentially, and to fully *debrief* all participants.

14: Is psychology free of value judgments?
Psychologists' values influence their choice of research topics, their theories and observations, their labels for behavior, and their professional advice. Applications of psychology's principles have been used mainly in the service of humanity.

Terms and Concepts to Remember

hindsight bias, p. 20
critical thinking, p. 24
theory, p. 25
hypothesis, p. 25
operational definition, p. 26
replication, p. 26
case study, p. 26
survey, p. 27
population, p. 28
random sample, p. 28
naturalistic observation, p. 28
correlation, p. 29
correlation coefficient, p. 29
scatterplot, p. 29
illusory correlation, p. 32
experiment, p. 34
random assignment, p. 34
double-blind procedure, p. 35
placebo effect, p. 35
experimental group, p. 35
control group, p. 35
independent variable, p. 35
confounding variable, p. 35
dependent variable, p. 35
mode, p. 37
mean, p. 38
median, p. 38
range, p. 39
standard deviation, p. 39
normal curve, p. 40
statistical significance, p. 41
culture, p. 43
informed consent, p. 45
debriefing, p. 45

AP* Practice Test Questions

Multiple-Choice Questions

1. What statistical technique would be appropriate for a researcher to use in trying to determine how consistent intelligence scores are over time?
   a. Correlation coefficient
   b. Mean
   c. Median
   d. Standard deviation
   e. Range

2. A scientist's willingness to admit that she is wrong is an example of
   a. curiosity.
   b. intelligence.
   c. humility.
   d. skepticism.
   e. cynicism.

3. Let's say a psychology researcher is interested in testing whether a particular parenting technique would lead adolescents to feel more satisfied with their lives. What method should be used?
   a. Case study
   b. Experiment
   c. Survey
   d. Naturalistic observation
   e. Correlation

4. When a distribution of scores is skewed, the best representation of central tendency is the
   a. inference.
   b. standard deviation.
   c. mean.
   d. median.
   e. correlation coefficient.

5. A researcher wants to conduct an experiment to determine if eating a cookie before class each day improves students' grades. He uses two psychology classes for the experiment, providing daily cookies to one and nothing to the other. At the end of the semester, the researcher compares the final grades of students in the two classes. What is the independent variable for this experiment?
   a. The students in the class that received cookies.
   b. The presence or absence of cookies.
   c. The students in the class that didn't receive cookies.
   d. The period of the day that the two classes met.
   e. Semester grades.

*AP is a trademark registered and/or owned by the College Board, which was not involved in the production of, and does not endorse, this product.

6. Which of the following represents naturalistic observation?
   a. From a third-floor window, researchers watch how elementary school children interact on a playground.
   b. Researchers bring people into a laboratory to see how they respond when asked to solve a puzzle with no solution.
   c. A principal sits in the back of a classroom to evaluate a teacher.
   d. A social worker spends the afternoon in the home of a mother accused of neglecting her children.
   e. Two grandparents sit in the front row to watch as their grandson performs his piano recital.

7. "Monday morning quarterbacks" rarely act surprised about the outcome of weekend football games. Their tendency to believe they knew how the game would turn out is explained by
   a. overconfidence.
   b. hindsight bias.
   c. intuition.
   d. illusory correlation.
   e. random sampling.

8. Researchers studying gender have found that
   a. there are more similarities than differences between the genders.
   b. there are no significant cognitive differences between the genders.
   c. there are no significant emotional differences between the genders.
   d. research tools are not capable of determining if there are true differences or not.
   e. differences between the genders are becoming more pronounced over time.

9. A student is writing an article for her school newspaper about the school's new cell-phone policy, and she'd like to include survey results from a random sample of students in her article. Which of the following constitutes a random sample?
   a. The writer arrives at school early and interviews the first five students who come through the main entrance.
   b. The writer pulls the names of five students from a hat that contains all students' names. She interviews the five selected students.
   c. The writer asks her teacher if she can distribute a brief survey to the students in her AP Psychology class.
   d. The writer passes out brief surveys to 50 students in the hall and uses the 18 surveys returned to her as the basis of her article.
   e. The writer asks the principal for the names of 10 students who have had their cell phones confiscated for a day for violating the policy. She interviews these 10 students.

10. Which of the following is a positive correlation?
    a. As study time decreases, students achieve lower grades.
    b. As levels of self-esteem decline, levels of depression increase.
    c. People who exercise regularly are less likely to be obese.
    d. Gas mileage decreases as vehicle weight increases.
    e. Repeatedly shooting free throws is associated with a smaller percentage of missed free throws.

11. Why is random assignment of participants to groups an important aspect of a properly designed experiment?
    a. If the participants are randomly assigned, the researcher can assume that the people in each of the groups are pretty similar.
    b. By randomly assigning, the researcher knows that whatever is learned from the experiment will also be true for the population from which the participants were selected.
    c. Random assignment keeps expectations from influencing the results of the experiment.
    d. If participants are not randomly assigned, it is impossible to replicate the experiment.
    e. Statistical analysis cannot be performed on an experiment if random assignment is not used.

12. Which of the following demonstrates the need for psychological science?
    a. Psychology's methods are unlike those of any other science.
    b. Psychological experiments are less valuable without psychological science.
    c. Intuition and common sense are not always correct.
    d. Intuition can never be right unless applied scientifically.
    e. Psychological science can be used to answer fundamental questions about religion.

13. Which of the following is a potential problem with case studies?
    a. They provide too much detail and the researcher is likely to lose track of the most important facts.
    b. They are generally too expensive to be economical.
    c. They may be misleading because they don't fairly represent other cases.
    d. They are technically difficult and most researchers don't have the skills to do them properly.
    e. The dependent variable is difficult to operationally define in a case study.

14. Which of the following is *not* an ethical principle regarding research on humans?
    a. Researchers must protect participants from needless harm and discomfort.
    b. Participants must take part in the study on a voluntary basis.
    c. Personal information about individual participants must be kept private.
    d. The research must be fully explained to participants when the study is completed.
    e. It is never acceptable for a researcher to deceive a participant during the research.

15. There is a negative correlation between TV watching and grades. What can we properly conclude from this discovery?
    a. We cannot conclude anything about cause and effect.
    b. We can conclude that TV watching leads to lower grades.
    c. We can conclude that TV watching increases grades.
    d. We can conclude that the grades students get have an effect on their TV watching habits.
    e. We can conclude that this is an illusory correlation.

Free-Response Question

Imagine that you are a sports psychologist interested in the usefulness of a new visualization technique that has been developed for Olympic divers. You have decided to conduct an experiment to determine if the technique is effective. Discuss the importance of each of the following in regard to the experiment you are designing: population, sample, hypothesis, independent variable, dependent variable, operational definitions, control group, random assignment, and replication.

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