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?"

Prescientific Psychology

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 does our mind work? How does our body relate to our mind? 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 eye-blink of human time.

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 Organum, 1620). 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 idea that what we know comes from experience, and that observation and experimentation enable scientific knowledge.

**Psychological Science Is Born**

What are some important milestones in psychology’s early development?

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. So began the first psychological laboratory, staffed by Wundt and by psychology’s first graduate students. (In 1883, Wundt’s American student G. Stanley Hall went on to establish the first formal U.S. psychology laboratory, at Johns Hopkins University.)

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 Modules 26–30), and two schools described in later modules: Gestalt psychology (Module 19) and psychoanalysis (Module 55).

**Wilhelm Wundt** Wundt established the first psychology laboratory at the University of Leipzig, Germany.
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.

Thinking About the Mind’s Functions

Hoping to assemble the mind’s structure from simple elements was rather like trying to understand a car by examining its disconnected parts. Philosopher-psychologist William James thought it would be more fruitful to consider the evolved functions of our thoughts and feelings. Smelling is what the nose does; thinking is what the brain does. But why do the nose and brain do these things? Under the influence of evolutionary theorist Charles Darwin, James assumed that thinking, like smelling, developed because it was adaptive—it contributed to our ancestors’ survival. Consciousness serves a function. It enables us to consider our past, adjust to our present, and plan our future. As a functionalist, James encouraged explorations of down-to-earth emotions, memories, willpower, habits, and moment-to-moment streams of consciousness.

James’s 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 Whiton Calkins into his graduate seminar (Scarborough & Furumoto, 1987). (In those years women lacked even the right to vote.) When Calkins joined, the other students (all men) dropped out. So James tutored her alone. Later, she finished all 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 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 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 2013—when women claimed two-thirds or more of new U.S. psychology Ph.D.s and were 9 of the 18 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**

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

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. Sigmund 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.”

---

**AP® Exam Tip**

There are lots of important people in psychology. As you study, focus on the significance of their accomplishments. You are more likely to be tested on what a finding means than who discovered it.
John B. Watson and Rosalie Rayner Working with Rayner, Watson championed psychology as the science of behavior and demonstrated conditioned responses on a baby who became famous as "Little Albert." (More about Watson's controversial study in Module 26.)

And so it continued until the 1920s, when the first of two larger-than-life American psychologists appeared on the scene. Flamboyant and provocative John B. Watson, and later the equally provocative B. F. Skinner, dismissed introspection and redefined psychology as "the scientific study of observable behavior." After all, they said, 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. They further suggested that our behavior is influenced by learned associations, through a process called conditioning. Many agreed, and the behaviorists were one of two major forces in psychology well into the 1960s. (More on these psychologists in Modules 26-30.)

The other major force was Freudian psychology, which emphasized the ways our unconscious thought processes and our emotional responses to childhood experiences affect our behavior. (In modules to come, we'll look more closely at Sigmund Freud's teachings, including his theory of personality and his views on unconscious sexual conflicts and the mind's defenses against its own wishes and impulses. We will also study the psychodynamic approach, which is the updated, modern-day version of Freud's ideas.)

As the behaviorists had done in the early 1900s, two other groups rejected the definition of psychology that was current in the 1960s. The first, the humanistic psychologists, led by Carl Rogers and Abraham Maslow, found both Freudian psychology and behaviorism too limiting. Rather than focusing on the meaning of early childhood memories or the learning of conditioned responses, the humanistic psychologists drew attention to ways that current environmental influences can nurture or limit our growth potential, and to the importance of having our needs for love and acceptance satisfied. (More on this in Module 57.)
The rebellion of a second group of psychologists during the 1960s is now known as the cognitive revolution, and it led the field back to its early interest in mental processes, such as the importance of how our mind processes and retains information. Cognitive psychology scientifically explores the ways we perceive, process, and remember information. Cognitive neuroscience, an interdisciplinary study, has enriched our understanding of the brain activity underlying mental activity. The cognitive approach has given us new ways to understand ourselves and to treat disorders such as depression, as we shall see in Module 71.

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 and more women contribute their ideas to the field?

► TEST YOURSELF
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.

Module 1 Review

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 power 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.

What are some important milestones in psychology’s early development?

- Wilhelm Wundt established the first psychological laboratory in 1879 in Germany.
- Two early schools of psychology were structuralism and functionalism.
- Structuralism, promoted by Wundt and Titchener, used self-reflection to learn about the mind’s structure. Functionalism, promoted by James, explored how behavior and thinking function.

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

- Early researchers defined psychology as a “science of mental life.”

- 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.
Psychology’s Big Issues and Approaches

Module Learning Objectives

2.1 Summarize the nature-nurture debate in psychology.

2.2 Describe psychology’s three main levels of analysis and related perspectives.

2.3 Identify psychology’s main subfields.

2.4 Explain how psychological principles can help you learn and remember, and do better on the AP® exam.

The young science of psychology developed from the more established fields of philosophy and biology. Wundt was both a philosopher and a physiologist. James was an American philosopher. Freud was an Austrian physician. Ivan Pavlov, who pioneered the study of learning (Module 26), was a Russian physiologist. Jean Piaget, the last century’s most influential observer of children (Module 47), was a Swiss biologist. These “Magellans of the mind,” as Morton Hunt (1993) has called them, illustrate psychology’s origins in many disciplines and many countries.

Like those early pioneers, today’s psychologists are citizens of many lands. The International Union of Psychological Science has 71 member nations, from Albania to Zimbabwe. In China, the first university psychology department began in 1978; by 2008 there were nearly 200 (Han, 2008; Tversky, 2008). Moreover, thanks to international publications, joint meetings, and the Internet, collaboration and communication now cross borders. Psychology is growing and it is globalization. The story of psychology—the subject of this book—continues to develop in many places, at many levels, with interests ranging from the study of nerve cell activity to the study of international conflicts.

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

2.1 What is psychology’s historic big issue?

Are our human traits present at birth, or do they develop through experience? This has been psychology’s biggest and most persistent issue. As we have seen, the debate over the nature-nurture issue is ancient. The ancient Greeks debated this, with Plato assuming that we
inherit character and intelligence 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. Descartes' views gained support from a curious naturalist two centuries later. In 1831, an indifferent student but ardent collector of beetles, mollusks, and shells set sail on a historic round-the-world journey. The 22-year-old voyager, Charles Darwin, pondered the incredible species variation he encountered, including tortoises on one island that differed from those on nearby islands. Darwin's 1859 *On the Origin of Species* explained this diversity by proposing the evolutionary process of natural selection: From among chance variations, nature selects traits that best enable an organism to survive and reproduce in a particular environment. Darwin's principle of natural selection—what philosopher Daniel Dennett (1996) has called "the single best idea anyone has ever had"—is still with us 150+ years later as biology's organizing principle. Evolution also has become an important principle for twenty-first-century psychology. This would surely have pleased Darwin, for he believed his theory explained not only animal structures (such as a polar bear's white coat) but also animal behaviors (such as the emotional expressions associated with human lust and rage).

The nature–nurture issue recurs throughout this text as today's psychologists explore the relative contributions of biology and experience, asking, for example, how we humans are alike (because of our common biology and evolutionary history) and diverse (because of our differing environments). Are gender differences biologically predisposed or socially constructed? Is children's grammar mostly innate or formed by experience? How are intelligence and personality differences influenced by heredity and by environment? Are sexual behaviors more "pushed" by inner biology or "pulled" by external incentives? Should we treat psychological disorders—depression, for example—as disorders of the brain, disorders of thought, or both?

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.
Psychology's Three Main Levels of Analysis

What are psychology's levels of analysis and related perspectives?

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

These tiered systems suggest different levels of analysis, which offer complementary outlooks. It's like explaining why horrific school shootings have occurred. Is it because the shooters have brain disorders or genetic tendencies that cause them to be violent? Because they have been rewarded for violent behavior? Because we, in the United States, live in a gun-promoting society that accepts violence? 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 2.1).

Biological Influences:
- natural selection of adaptive traits
- genetic predispositions responding to environment
- brain mechanisms
- hormonal influences

Psychological Influences:
- learned fears and other learned expectations
- emotional responses
- cognitive processing and perceptual interpretations

Social-cultural Influences:
- presence of others
- cultural, societal, and family expectations
- peer and other group influences
- compelling models (such as in the media)

Each level provides a valuable vantage point for looking at a behavior or mental process, 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 2.1 on the next page complement one another. Consider, for example, how they shed light on anger.

![Figure 2.1 Biopsychosocial approach](image)

---

**AP® Exam Tip**

You will see versions of Figure 2.1 throughout the text. Spend some time right now familiarizing yourself with how the figure's three corners might contribute to behavior or mental processes, the very stuff of psychology.

**Views of anger** How will each of psychology's levels of analysis explain what's going on here?
### Table 2.1 Psychology’s Approaches

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Focus</th>
<th>Sample Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral</td>
<td>How we learn observable responses</td>
<td>How do we learn to fear particular objects or situations? What is the most effective way to alter our behavior, say, to lose weight?</td>
</tr>
<tr>
<td>Biological</td>
<td>How the body and brain enable emotions, memories, and sensory experiences; how genes combine with environment to influence individual differences</td>
<td>How do pain messages travel from the hand to the brain? 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?</td>
</tr>
<tr>
<td>Cognitive</td>
<td>How we encode, process, store, and retrieve information</td>
<td>How do we use information in remembering? Reasoning? Solving problems?</td>
</tr>
<tr>
<td>Evolutionary</td>
<td>How the natural selection of traits has promoted the survival of genes</td>
<td>How does evolution influence behavior tendencies?</td>
</tr>
<tr>
<td>Humanistic</td>
<td>How we meet our needs for love and acceptance and achieve self-fulfillment</td>
<td>How can we work toward fulfilling our potential? How can we overcome barriers to our personal growth?</td>
</tr>
<tr>
<td>Psychodynamic</td>
<td>How behavior springs from unconscious drives and conflicts</td>
<td>How can someone’s personality traits and disorders be explained by unfulfilled wishes and childhood traumas?</td>
</tr>
<tr>
<td>Social-cultural</td>
<td>How behavior and thinking vary across situations and cultures</td>
<td>How are we alike as members of one human family? How do we differ as products of our environment?</td>
</tr>
</tbody>
</table>

### AP® Exam Tip

These perspectives will come up again and again throughout your AP® Psychology course, and they will be on the exam. You need to become very comfortable with the meaning of terms like cognitive, behavioral, and psychodynamic. Ask your teacher for clarification if you are the least bit unclear about what the perspectives mean.

- Someone working from the **behavioral** perspective might attempt to determine which external stimuli trigger angry responses or aggressive acts.
- 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 **cognitive** perspective might study how our interpretation of a situation affects our anger and how our anger affects our thinking.
- Someone working from the **evolutionary** perspective might analyze how anger facilitated the survival of our ancestors’ genes.
- 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. As we will see, modern-day positive psychology incorporates humanistic psychology’s emphasis on human flourishing.
- Someone working from the **psychodynamic** perspective (which evolved from Freud’s psychoanalysis) might view an outburst as an outlet for unconscious hostility.
- Someone working from the **social-cultural** perspective might explore how expressions of anger vary across cultural contexts.

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

What are psychology's main subfields?

Ficturing a chemist at work, you probably envision a white-coated scientist surrounded by glassware and high-tech equipment. Picture a psychologist at work and you would be right to envision:

- a white-coated scientist probing a rat's brain.
- an intelligence researcher measuring how quickly an infant shows boredom by looking away from a familiar picture.
- an executive evaluating a new “healthy lifestyles” training program for employees.
- someone at a computer analyzing data on whether adopted teens’ temperaments more closely resemble those of their adoptive parents or their biological parents.
- a therapist listening carefully to a client’s depressed thoughts.
- a 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.

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

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

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

social-cultural psychology the study of how situations and culture affect our behavior and thinking.

psychometrics the scientific study of the measurement of human abilities, attitudes, and traits.
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 group therapy.

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

**developmental psychology** a branch of psychology that studies 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.

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.

(Read on to the next module for a more complete list of what psychologists in various professions do and where they work.)

These and other psychologists also may conduct **applied research**, tackling practical problems. **Industrial-organizational (I/O) psychologists**, for example, use psychology's concepts and methods in the workplace to help organizations and companies select and train employees, boost morale and productivity, design products, and implement systems. Within that domain, **human factors psychologists** focus on the interaction of people, machines, and physical environments. (More on this subject in Enrichment Module 82.)

Although most psychology textbooks focus on psychological science, psychology is also a helping profession devoted to such practical issues as how to have a happy marriage, how to overcome anxiety or depression, and how to raise thriving children. As a science, psychology at its best bases such interventions on evidence of effectiveness. **Counseling psychologists** help people to cope with challenges and crises (including academic, vocational, and marital issues) and to improve their personal and social functioning. **Clinical psychologists** assess and treat mental, emotional, and behavior disorders. Both counseling and clinical psychologists administer and interpret tests, provide counseling and therapy, and sometimes conduct basic and applied research. By contrast, **psychiatrists**, who also may provide psychotherapy, are medical doctors licensed to prescribe drugs and otherwise treat physical causes of psychological disorders.

We will study the history of therapy, including the role of pioneering Dorothea Dix, in the Therapy unit. Reformers such as Dix and Philippe Pinel led the way to humane treatment of those with psychological disorders.

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

Rather than seeking to change people to fit their environment, community psychologists work to create social and physical environments that are healthy for all (Bradshaw et al., 2009; Trickett, 2009). For example, if school bullying is a problem, some psychologists will seek to change the bullies. Knowing that many students struggle with the transition from elementary to middle school, they might train individual kids how to cope. Community psychologists instead seek ways to adapt the school experience to early adolescent needs.

To prevent bullying, they might study how the school and neighborhood foster bullying.

With perspectives ranging from the biological to the social, and with settings from the laboratory to the clinic, psychology relates to many fields. As we will see in Module 3, 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 psychophysiology (the psychological analysis of historical characters), psycholinguistics (the study of language and thinking), and psychosocial (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 about psychology’s findings also changes people: They less often judge psychological disorders as moral failings, treatable by punishment and ostracism. They less often regard and treat women as men’s mental inferiors. They less often view and rear children as ignorant, willful beasts in need of taming. “In each case,” noted Morton Hunt (1990, p. 206), “knowledge has modified attitudes, and, through them, behavior.” Once aware of psychology’s well-researched ideas—about how body and mind connect, how a child’s mind grows, how we construct our perceptions, how we remember (and misremember) our experiences, how people across the world differ (and are alike)—your mind may never again be quite the same.

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

Although many of life’s significant questions are beyond psychology, some very important ones are illuminated by even a first psychology course. Through painstaking research, psychologists have gained insights into brain and mind, dreams and memories, depression and joy. Even the unanswered questions can renew our sense of mystery about “things too wonderful” for us yet to understand. And, as you will see in Modules 4–8, your study of psychology can help teach you how to ask and answer important questions—how to think critically as you evaluate competing ideas and claims.

Psychology deepens our appreciation for how we humans perceive, think, feel, and act. By so doing, it can indeed enrich our lives and enlarge our vision. Throughout 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.”

---

¹Confession: I wrote the last part of this sentence on April Fool’s Day.
Module 3

Careers in Psychology

Module Learning Objective

Describe what psychologists in various professions do and where they work.

This module was written by Jennifer Zwolinski, Associate Professor of Psychology at the University of San Diego.

What do psychologists in various professions do, and where do they work?

What can you do with a college degree in psychology? Lots!

If you major in psychology, you will graduate with a scientific mind-set and an awareness of basic principles of human behavior (biological mechanisms, development, cognition, psychological disorders, social interaction). This background will prepare you for success in many areas, including business, the helping professions, health services, marketing, law, sales, and teaching. You may even go on to graduate school for specialized training to become a psychology professional. This module describes psychology's specialized subfields. Appendix D, Preparing for Further Psychology Studies, provides tips for preparing to earn a bachelor’s, master’s, or doctoral degree in psychology, with information about the career options that become available at those varying levels of education.

If you are like most students, you may be unaware of the wide variety of specialties and work settings available in psychology (Terre & Stoddart, 2000). To date, the American Psychological Association (APA) has formed 56 divisions. Let’s look at some of the basic research, applied research, and helping profession careers (arranged alphabetically) in the main specialty areas of psychology, most of which require a graduate degree in psychology.

Basic Research Subfields

Cognitive psychologists study thought processes and focus on such topics as perception, language, attention, problem solving, memory, judgment and decision making, forgetting, and intelligence. Research interests include designing computer-based models of thought processes and identifying biological correlates of cognition. As a cognitive psychologist, you might work as a professor, industrial consultant, or human factors specialist in an educational or business setting.
DEVELOPMENTAL PSYCHOLOGISTS conduct research on age-related behavioral changes and apply their scientific knowledge to educational, child-care, policy, and related settings. As a developmental psychologist, you would investigate change across a broad range of topics, including the biological, psychological, cognitive, and social aspects of development. Developmental psychology informs a number of applied fields, including educational psychology, school psychology, child psychopathology, and gerontology. The field also informs public policy in areas such as education and child-care reform, maternal and child health, and attachment and adoption. You would probably specialize in a specific stage of the life span, such as infancy, childhood, adolescence, or middle or late adulthood. Your work setting could be an educational institution, day-care center, youth group program, or senior center.

EDUCATIONAL PSYCHOLOGISTS are interested in the psychological processes involved in learning. They study the relationship between learning and physical and social environments, and they develop strategies for enhancing the learning process. As an educational psychologist, working in a university psychology department or school of education, you might conduct basic research on topics related to learning or develop innovative methods of teaching to enhance the learning process. You might design effective tests, including measures of aptitude and achievement. You might be employed by a school or government agency or charged with designing and implementing effective employee-training programs in a business setting.

EXPERIMENTAL PSYCHOLOGISTS are a diverse group of scientists who investigate a variety of basic behavioral processes in humans and other animals. Prominent areas of experimental research include comparative methods of science, motivation, learning, thought, attention, memory, perception, and language. Most experimental psychologists identify with a particular subfield, such as cognitive psychology, depending on their interests and training. It is important to note that experimental research methods are not limited to the field of experimental psychology; many other subfields rely on experimental methodology to conduct studies. As an experimental psychologist, you would most likely work in an academic setting, teaching courses and supervising students’ research in addition to conducting your own research. Or you might be employed by a research institution, zoo, business, or government agency.

PSYCHOMETRIC AND QUANTITATIVE PSYCHOLOGISTS study the methods and techniques used to acquire psychological knowledge. A psychometrician may update existing neurocognitive or personality tests or devise new tests for use in clinical and school settings or in business and industry. These psychologists also administer, score, and interpret such tests. Quantitative psychologists collaborate with researchers to design, analyze, and interpret the results of research programs. As a psychometric or quantitative psychologist, you will need to be well trained in research methods, statistics, and computer technology. You will most likely be employed by a university or college, testing company, private research firm, or government agency.

SOCIAL PSYCHOLOGISTS are interested in our interactions with others. Social psychologists study how our beliefs, feelings, and behaviors are affected by and influence other people. They study topics such as attitudes, aggression, prejudice, interpersonal attraction, group behavior, and leadership. As a social psychologist, you would probably be a college or university faculty member. You might also work in organizational consultation, market research, or other applied psychology fields, including social neuroscience. Some social psychologists work for hospitals, federal agencies, or businesses performing applied research.
Applied Research Subfields

FORENSIC PSYCHOLOGISTS apply psychological principles to legal issues. They conduct research on the interface of law and psychology, help to create public policies related to mental health, help law-enforcement agencies in criminal investigations, or consult on jury selection and deliberation processes. They also provide assessment to assist the legal community. Although most forensic psychologists are clinical psychologists, they might have expertise in other areas of psychology, such as social or cognitive psychology. Some also hold law degrees. As a forensic psychologist, you might work in a university psychology department, law school, research organization, community mental health agency, law-enforcement agency, court, or correctional setting.

HEALTH PSYCHOLOGISTS are researchers and practitioners concerned with psychology’s contribution to promoting health and preventing disease. As applied psychologists or clinicians, they may help individuals lead healthier lives by designing, conducting, and evaluating programs to stop smoking, lose weight, improve sleep, manage pain, prevent the spread of sexually transmitted infections, or treat psychosocial problems associated with chronic and terminal illnesses. As researchers and clinicians, they identify conditions and practices associated with health and illness to help create effective interventions. In public service, health psychologists study and work to improve government policies and health care systems. As a health psychologist, you could be employed in a hospital, medical school, rehabilitation center, public health agency, college or university, or, if you are also a clinical psychologist, in private practice.

INDUSTRIAL-ORGANIZATIONAL (I/O) PSYCHOLOGISTS study the relationship between people and their working environments. They may develop new ways to increase productivity, improve personnel selection, or promote job satisfaction in an organizational setting. Their interests include organizational structure and change, consumer behavior, and personnel selection and training. As an I/O psychologist, you might conduct workplace training or provide organizational analysis and development. You might find yourself working in business, industry, the government, or a college or university. Or you may be self-employed as a consultant or work for a management consulting firm.

NEUROPSYCHOLOGISTS investigate the relationship between neurological processes (structure and function of the nervous system) and behavior. As a neuropsychologist you might assess, diagnose, or treat central nervous system disorders, such as Alzheimer’s disease or stroke. You might also evaluate individuals for evidence of head injuries; learning and developmental disabilities, such as autism spectrum disorder; and other psychiatric disorders, such as attention-deficit/hyperactivity disorder (ADHD). If you are a clinical neuropsychologist, you might work in a hospital’s neurology, neurosurgery, or psychiatric unit. Neuropsychologists also work in academic settings, where they conduct research and teach.

REHABILITATION PSYCHOLOGISTS are researchers and practitioners who work with people who have lost optimal functioning after an accident, illness, or other event. As a rehabilitation psychologist, you would probably work in a medical rehabilitation institution or hospital. You might also work in a medical school, university, state or federal vocational rehabilitation agency, or in private practice serving people with physical disabilities.
**SCHOOL PSYCHOLOGISTS** are involved in the assessment of and intervention for children in educational settings. They diagnose and treat cognitive, social, and emotional problems that may negatively influence children's learning or overall functioning at school. As a school psychologist, you would collaborate with teachers, parents, and administrators, making recommendations to improve student learning. You could work in an academic setting, a federal or state government agency, a child guidance center, or a behavioral research laboratory.

**SPORT PSYCHOLOGISTS** study the psychological factors that influence, and are influenced by, participation in sports and other physical activities. Their professional activities include coach education and athlete preparation, as well as research and teaching. Sport psychologists who also have a clinical or counseling degree can apply those skills to working with individuals with psychological problems, such as anxiety or substance abuse, that might interfere with optimal performance. As a sport psychologist, if you were not working in an academic or research setting, you would most likely work as part of a team or organization, or in a private capacity.

**The Helping Professions**

**CLINICAL PSYCHOLOGISTS** promote psychological health in individuals, groups, and organizations. Some clinical psychologists specialize in specific psychological disorders. Others treat a range of disorders, from adjustment difficulties to severe psychopathology. Clinical psychologists might engage in research, teaching, assessment, and consultation. Some hold workshops and lectures on psychological issues for other professionals or for the public. Clinical psychologists work in a variety of settings, including private practice, mental health service organizations, schools, universities, industries, legal systems, medical systems, counseling centers, government agencies, and military services.

To become a clinical psychologist, you will need to earn a doctorate from a clinical psychology program. The APA sets the standards for clinical psychology graduate programs, offering accreditation (official recognition) to those who meet their standards. In all U.S. states, clinical psychologists working in independent practice must obtain a license to offer services such as therapy and testing.

**COMMUNITY PSYCHOLOGISTS** move beyond focusing on specific individuals or families and deal with broad problems of mental health in community settings. These psychologists believe that human behavior is powerfully influenced by the interaction between people and their physical, social, political, and economic environments. They seek to promote psychological health by enhancing environmental settings, focusing on preventive measures and crisis intervention, with special attention to the problems of underserved groups and ethnic minorities. Given the shared emphasis on prevention, some community psychologists collaborate with...
professionals in other areas, such as public health. As a community psychologist, your work settings could include federal, state, and local departments of mental health, corrections, and welfare. You might conduct research or help evaluate research in health service settings, serve as an independent consultant for a private or government agency, or teach and consult as a college or university faculty member.

**COUNSELING PSYCHOLOGISTS** help people adjust to life transitions or make lifestyle changes. Although similar to clinical psychologists, counseling psychologists typically help people with adjustment problems rather than severe psychopathology. Like clinical psychologists, counseling psychologists conduct therapy and provide assessments to individuals and groups. As a counseling psychologist, you would emphasize your client’s strengths, helping them to use their own skills, interests, and abilities to cope during transitions. You might find yourself working in an academic setting as a faculty member or administrator or in a university counseling center, community mental health center, business, or private practice. As with clinical psychology, if you plan to work in independent practice you will need to obtain a state license to provide counseling services to the public.

***

So, the next time someone asks you what you could do with a psychology degree, tell them you will have a lot of options. You might use your acquired skills and understanding to get a job and succeed in any number of fields, or you might pursue graduate school and then career opportunities in associated professions. In any case, what you have learned about behavior and mental processes will surely enrich your life (Hammer, 2003).

---

**Module 3 Review**

**What do psychologists in various professions do, and where do they work?**

- The APA has formed 56 divisions.
- Psychology’s specialties include the basic research subfields (cognitive, developmental, educational, experimental, psychometric and quantitative, and social psychology); the applied research subfields (forensic, health, industrial-organizational, neuropsychology, rehabilitation, school, and sport psychology); and the helping professions (clinical, community, and counseling).
- Work settings for psychologists include a wide range of government agencies, industrial and business settings, clinics and counseling centers, health care institutions, schools, universities, and research organizations.

---

**Before You Move On**

**ASK YOURSELF**

Which of psychology’s specialties were you aware of before taking this course? Which seem most interesting to you?

**TEST YOURSELF**

Name the subfields that focus on a) people and their work environments, b) how people change over the life span, c) the human thinking involved in perceiving, remembering, speaking, and decision making, and d) diagnosing and treating psychological disorders.

*Answers to the Test Yourself questions can be found in Appendix E at the end of the book.*
Module 4

The Need for Psychological Science

Module Learning Objectives

4-1 Describe how hindsight bias, overconfidence, and the tendency to perceive order in random events illustrate why science-based answers are more valid than those based on intuition and common sense.

4-2 Identify how the three main components of the scientific attitude relate to critical thinking.

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

Some people suppose that psychology merely documents and dresses in jargon what people already know: “So what else is new—you get paid for using fancy methods to prove what 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).

Prince Charles has much company, judging from the long list of pop psychology books on “intuitive managing,” “intuitive trading,” and “intuitive healing.” 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, off-screen. Like jumbo jets, we fly mostly on autopilot.

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

This much seems certain: We often underestimate intuition’s perils. My geographical intuition tells me that Reno is east of Los Angeles, that Rome is south of New York, that Atlanta is east of Detroit. But I am wrong, wrong, and wrong.

Modules 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. As a Nobel Prize-winning physicist explained, “The first principle is that you must not fool yourself—and you are the easiest person to fool” (Feynman, 1997).
Indeed, observed novelist Madeleine L’Engle, “The naked intellect is an extraordinarily inaccurate instrument” (1973). Three phenomena—hindsight bias, judgmental overconfidence, and our tendency to perceive patterns in random events—illustrate why we cannot rely solely on intuition and common sense.

Did We Know It All Along? Hindsight Bias

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

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

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

Such errors in our recollections and explanations show why we need psychological research. Just asking people how and why they felt or acted as they did can sometimes be misleading—not because common sense is usually wrong, but because common sense more easily describes what has happened than what will happen. As physicist Niels Bohr reportedly said, “Prediction is very difficult, especially about the future.”

Some 100 studies have observed hindsight bias 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

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

*Life is lived forwards, but understood backwards.* -PHILOSOPHER SOREN KIERKEGAARD, 1813-1855

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.)

*Anything seems commonplace, once explained.* -DR. WATSON TO SHERLOCK HOLMES

Hindsight bias When drilling the Deepwater Horizon oil well in 2010, BP employees took some shortcuts and ignored some warning signs, without intending to harm the environment or their company’s reputation. After the resulting Gulf oil spill, with the benefit of 20/20 hindsight, the foolishness of those judgments became obvious.
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 Module 40 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. (Why did it take so long for someone to invent suitcases on wheels and Post-it Notes?)

But sometimes our intuition, informed by countless casual observations, has it wrong. In later modules we will see how research has overturned popular ideas—that familiarity breeds contempt, that dreams predict the future, and that most of us use only 10 percent of our brain. (See also TABLE 4.1.) 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.

<table>
<thead>
<tr>
<th>Table 4.1 True or False?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychological research discussed in modules 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.)</td>
</tr>
<tr>
<td>1. If you want to teach a habit that persists, reward the desired behavior every time, not just intermittently (see Module 27).</td>
</tr>
<tr>
<td>2. Patients whose brains are surgically split down the middle survive and function much as they did before the surgery (see Module 13).</td>
</tr>
<tr>
<td>3. Traumatic experiences, such as sexual abuse or surviving the Holocaust, are typically &quot;repressed&quot; from memory (see Module 33).</td>
</tr>
<tr>
<td>4. Most abused children do not become abusive adults (see Module 50).</td>
</tr>
<tr>
<td>5. Most infants recognize their own reflection in a mirror by the end of their first year (see Module 47).</td>
</tr>
<tr>
<td>6. Adopted siblings usually do not develop similar personalities, even though they are reared by the same parents (see Module 14).</td>
</tr>
<tr>
<td>7. Fears of harmless objects, such as flowers, are just as easy to acquire as fears of potentially dangerous objects, such as snakes (see Module 15).</td>
</tr>
<tr>
<td>8. Lie detection tests often lie (see Module 41).</td>
</tr>
<tr>
<td>9. The brain remains active during sleep (see Modules 22–23).</td>
</tr>
</tbody>
</table>


Overconfidence

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

WREAT → WATER
ETRYN → ENTRY
GRABE → BARGE
Perceiving Order in Random Events

In our natural eagerness to make some of our-world-what孔雀 Wallace Stevens called our “rage for order” - we are prone to perceive patterns. People see a face on the moon, hear Sanatc messages in music, perceive the Virgin Mary’s image on a grilled cheese sandwich. Even in random data, we often find order, because—here’s a curious fact—our minds want to see patterns.

In actual random sequences, patterns and streaks (such as repeating digits) occur more often than people expect (Chater et al., 2009). To demonstrate this phenomenon for myself, I flipped a coin 51 times with these results (FIGURE 4.1).

Figure 4.1

Two random sequences of 51 coin tosses.

Looking over the sequence patterns jump out. Tosses 10 to 12 provided an almost perfect pattern of pairs of tails. On tosses 30 to 32, 33 to 36 and 38 I had a cold hand, with only one head in nine tosses. But my fortunes immediately reversed with a hot hand—seven heads out of the next nine tosses. Similar streaks happen about as often as one would expect in random sequences in baseball, shooting basketball, hit-and-run mutual fund stock picking. In each case the sequence was immediately overinterpreted: Wall Street traders “get hot” after a string of successful trades, and lucky numbers are overinterpreted. (When you’re hot, you’re hot.)

In our natural eagerness to make sense of our world, what poet Wallace Stevens called our “rage for order” - we are prone to perceive patterns. People see a face on the moon, hear Sanatc messages in music, perceive the Virgin Mary’s image on a grilled cheese sandwich. Even in random data, we often find order, because—here’s a curious fact—our minds want to see patterns.

In actual random sequences, patterns and streaks (such as repeating digits) occur more often than people expect (Chater et al., 2009). To demonstrate this phenomenon for myself, I flipped a coin 51 times with these results (FIGURE 4.1).

Figure 4.1

Two random sequences of 51 coin tosses.

Looking over the sequence patterns jump out. Tosses 10 to 12 provided an almost perfect pattern of pairs of tails. On tosses 30 to 32, 33 to 36 and 38 I had a cold hand, with only one head in nine tosses. But my fortunes immediately reversed with a hot hand—seven heads out of the next nine tosses. Similar streaks happen about as often as one would expect in random sequences in baseball, shooting basketball, hit-and-run mutual fund stock picking. In each case the sequence was immediately overinterpreted: Wall Street traders “get hot” after a string of successful trades, and lucky numbers are overinterpreted. (When you’re hot, you’re hot.)
What explains these streaky patterns? Was I exercising some sort of paranormal control over my coin? Did I snap out of my tails funk and get in a heads groove? No such explanations are needed, for these are the sorts of streaks found in any random data. Comparing each toss to the next, 23 of the 50 comparisons yielded a changed result—just the sort of near 50-50 result we expect from coin tossing. Despite seeming patterns, the outcome of one toss gives no clue to the outcome of the next.

However, some happenings seem so extraordinary that we struggle to conceive an ordinary, chance-related explanation (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. And given the millions of people who buy U.S. state lottery tickets, statisticians Stephen Samuels and George McCabe (1989) reported, it was "practically a sure thing" that someday, somewhere, someone would hit a state jackpot twice. Indeed, said fellow statisticians Persi Diaconis and Frederick Mosteller (1989), "with a large enough sample, any outrageous thing is likely to happen." An event that happens to but 1 in 1 billion people every day occurs about 7 times a day, 2500 times a year.

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

The Scientific Attitude: Curious, Skeptical, and Humble

How do the scientific attitude's three main components relate to critical thinking?

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

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

Randi: Do you see an aura around my head?
Aura-seer: Yes, indeed.
Randi: Can you still see the aura if I put this magazine in front of my face?
Aura-seer: Of course.
Randi: Then if I were to step behind a wall barely taller than I am, you could determine my location from the aura visible above my head, right?

Randi told me that no aura-seer has agreed to take this simple test.

No matter how sensible—seeming or wild an idea, the smart thinker asks: Does it work? When put to the test, can its predictions be confirmed? Subjected to such scrutiny, crazy-sounding ideas sometimes find support. During the 1700s, scientists scoffed at the notion that meteorites had extraterrestrial origins. When two Yale scientists challenged 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, sending crazy-sounding ideas to the waste heap, atop previous claims of perpetual motion machines, miracle cancer cures, and out-of-body travels into centuries past. To sift reality from fantasy, sense from nonsense, therefore requires a scientific attitude: being skeptical but not cynical, open but not gullible.
"To believe with certainty," says a Polish proverb, "we must begin by doubting." As scientists, psychologists approach the world of behavior with a curious skepticism, persistently asking two questions: What do you mean? How do you know?

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? Is electroconvulsive therapy (delivering an electric shock to the brain) an effective treatment for severe depression? As we will see, putting such claims to the test has led psychological scientists to answer No to the first two questions and Yes to the third.

Putting a scientific attitude into practice requires not only curiosity and skepticism but also humility—an awareness of our own vulnerability to error and an openness to surprises and new perspectives. In the last analysis, what matters is not my opinion or yours, but the truths nature reveals in response to our questioning. If people or other animals don't behave as our ideas predict, then so much the worse for our ideas. This humble attitude was expressed in one of psychology's early mottoes: "The rat is always right."

Historians of science tell us that these three attitudes—curiosity, skepticism, and humility—help make modern science possible. Some deeply religious people today may view science, including psychological science, as a threat. Yet, many of the leaders of the scientific revolution, including Copernicus and Newton, were deeply religious people acting on the idea that "in order to love and honor God, it is necessary to fully appreciate the wonders of his handiwork" (Stark, 2003a,b).

Non Sequitur

![Image]

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

Critical Thinking

The scientific attitude prepares us to think smarter. Smart thinking, called critical thinking, examines assumptions, assesses the source, discerns hidden values, confirms 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?

Critical thinking, informed by science, helps clear the colored lenses of our biases. Consider: Does climate change threaten our future, and, if so, is it human-caused? In 2009, climate-action advocates interpreted an Australian heat wave and dust storms as evidence of climate change. In 2010, climate-change skeptics perceived North American bitter cold and East Coast blizzards as discounting global warming. Rather than having their understanding
of climate change swayed by today’s weather, or by their own political views, critical thinkers say, “Show me the evidence.” Over time, is the Earth actually warming? Are the polar ice caps melting? Are vegetation patterns changing? And is human activity spewing gases that would lead us to expect such changes? When contemplating such issues, critical thinkers will consider the credibility of sources. They will look at the evidence (“Do the facts support them, or are they just makin’ stuff up?”). They will recognize multiple perspectives. And they will expose themselves to news sources that challenge their preconceived ideas.

Has psychology’s critical inquiry been open to surprising findings? The answer, as ensuing modules illustrate, is plainly Yes. Believe it or not, massive losses of brain tissue early in life may have minimal long-term effects (see Module 12). Within days, newborns can recognize their mother’s odor and voice (see Module 45). After brain damage, a person may be able to learn new skills yet be unaware of such learning (see Modules 31–33). Diverse groups—men and women, old and young, rich and middle class, those with disabilities and without—report roughly comparable levels of personal happiness (see Module 83).

And has critical inquiry convincingly debunked popular presumptions? The answer, as ensuing modules also illustrate, is again Yes. The evidence indicates that sleepwalkers are not acting out their dreams (see Module 34). 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 Module 83). Most people do not suffer from unrealistically low self-esteem, and high self-esteem is not all good (see Module 59). Opposites do not generally attract (see Module 79). In each of these instances and more, what has been learned is not what is widely believed.

**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**

How does the scientific attitude contribute to critical thinking?

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

**Module 4 Review**

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

- **Hindsight bias** (also called the “I-knew-it-all-along phenomenon”) is the tendency to believe, after learning an outcome, that we would have foreseen it.
- Overconfidence in our judgments results partly from our bias to seek information that confirms them.
- These tendencies, plus our eagerness to perceive patterns in random events, lead us to overestimate our intuition.

Although limited by the testable questions it can address, scientific inquiry can help us overcome our intuition’s biases and shortcomings.

How do the scientific attitude’s three main components relate to critical thinking?

- The scientific attitude equips us to be curious, skeptical, and humble in scrutinizing competing ideas or our own observations.
- This attitude carries into everyday life as **critical thinking**, which puts ideas to the test by examining assumptions, assessing the source, discerning hidden values, evaluating evidence, and assessing conclusions.
Module 5

The Scientific Method and Description

Module Learning Objectives

- Describe how theories advance psychological science.
- Describe how psychologists use case studies, naturalistic observation, and surveys to observe and describe behavior, and explain the importance of random sampling.

Psychologists arm their scientific attitude with the *scientific method*—a self-correcting process for evaluating ideas with observation and analysis. In its attempt to describe and explain human nature, psychological science welcomes hunches and plausible-sounding theories. And it puts them to the test. If a theory works—if the data support its predictions—so much the better for that theory. If the predictions fail, the theory will be revised or rejected.

The Scientific Method

**How do theories advance psychological science?**

Chatting with friends and family, we often use theory to mean “mere hunch.” In science, a **theory** explains behaviors or events by offering ideas that organize what we have observed. By organizing isolated facts, a theory simplifies. By linking facts with deeper principles, a theory offers a useful summary. As we connect the observed dots, a coherent picture emerges.

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

Yet no matter how reasonable a theory may sound—and it does seem reasonable to suggest that sleep could improve memory—we must put it to the test. A good theory produces testable predictions, called **hypotheses**. Such predictions specify what results (what behaviors or events) would support the theory and what results would cast doubt on the theory. To test our theory about the effects of sleep on memory, our hypothesis might be that when sleep deprived, people will remember less from the day before. To test that hypothesis, we might assess how well people remember course materials they studied before a good night’s sleep, or before a shortened night’s sleep (**Figure 5.1**). The results will either confirm our theory or lead us to revise or reject it.
Our theories can bias our observations. Having theorized that better memory springs from more sleep, we may see what we expect: We may perceive sleepy people’s comments as less insightful. 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 use operational definitions when they report their studies. “Sleep deprived,” for example, may be defined as “X hours less” than the person’s natural sleep. Unlike dictionary definitions, operational definitions describe concepts with precise procedures or measures. These exact descriptions will allow anyone to replicate (repeat) the research. Other people can then re-create the study with different participants and in different situations. If they get similar results, we can be confident that the findings are reliable.

Let’s summarize. A good theory:

- effectively organizes a range of self-reports and observations.
- leads to clear hypotheses (predictions) that anyone can use to check the theory.
- often stimulates research that leads to a revised theory which better organizes and predicts what we know. Or, our research may be replicated and supported by similar findings. (This has been the case for sleep and memory studies, as you will see in Module 24.)

We can test our hypotheses and refine our theories in several ways.

- Descriptive methods describe behaviors, often by using case studies, surveys, or naturalistic observations.
- Correlational methods associate different factors, or variables. (You’ll see the word variable often in descriptions of research. It refers to anything that contributes to a result.)
- Experimental methods manipulate variables to discover their effects.

To think critically about popular psychology claims, we need to understand the strengths and weaknesses of these methods.
Description

How do psychologists use case studies, naturalistic observation, and surveys to observe and describe behavior, and why is random sampling important?

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

- case studies (analyses of special individuals).
- naturalistic observation (watching and recording the natural behavior of many individuals).
- surveys and interviews (by asking people questions).

The Case Study

Psychologists use the case study, which is among the oldest research methods, to examine one individual or group in depth in the hope of revealing things true of all of us. 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 through case studies in which he carefully observed and questioned individual children. Studies of only a few chimpanzees have revealed their capacity for understanding and language. Intensive case studies are sometimes very revealing. They show us what can happen, and they often suggest directions for further study.

But individual cases may mislead us if the individual is atypical. Unrepresentative information can lead to mistaken judgments and false conclusions. Indeed, anytime a researcher mentions a finding (“Smokers die younger: ninety-five 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 89”). Dramatic stories and personal experiences (even psychological case examples) command our attention and are easily remembered. Journalists understand that, and so begin an article about bank foreclosures with the sad story of one family put out of their house, not with foreclosure statistics. Stories move us. But stories can mislead. Which of the following do you find more memorable? (1) “In one study of 1300 dream reports concerning a kidnapped child, only 5 percent correctly envisioned the child as dead” (Murray & Wheeler, 1937). (2) “I know a man who dreamed his sister was in a car accident, and two days later she died in a head-on collision!” Numbers can be numbing, but the plural of anecdote is not evidence. As psychologist Gordon Allport (1954, p. 9) said, “Given a thimbleful of [dramatic] facts we rush to make generalizations as large as a tub.”

The point to remember: Individual cases can suggest fruitful ideas. What’s true of all of us can be glimpsed in any one of us. But to discern the general truths that cover individual cases, we must answer questions with other research methods.

Naturalistic Observation

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

Like the case study, naturalistic observation does not explain behavior. It describes it. Nevertheless, descriptions can be revealing. We once thought, for example, that only humans use tools. Then naturalistic observation revealed that chimpanzees sometimes insert a stick in a termite mound and withdraw it, eating the stick’s load of termites.
Such unobtrusive naturalistic observations paved the way for later studies of animal thinking, language, and emotion, which further expanded our understanding of our fellow animals. "Observations, made in the natural habitat, helped to show that the societies and behavior of animals are far more complex than previously supposed," chimpanzee observer Jane Goodall noted (1998). Thanks to researchers' observations, we know that chimpanzees and baboons use deception. Psychologists Andrew Whiten and Richard Byrne (1988) repeatedly saw one young baboon pretending to have been attacked by another as a tactic to get its mother to drive the other baboon away from its food. The more developed a primate species' brain, the more likely it is that the animals will display deceptive behaviors (Byrne & Corp, 2004).

Naturalistic observations also illuminate human behavior. Here are four 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, spaced about one-fifth of a second apart (Provine, 2001).

- **Sounding out students.** What, really, are college psychology students saying and doing during their everyday lives? To find out, researchers equipped 52 such students from the University of Texas with electronic recorders (Mehl & Pennebaker, 2003). 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?)

- **What's on your mind?** To find out what was on the mind of their University of Nevada, Las Vegas, students, researchers gave them beepers (Heavey & Hurlbut, 2008). On a half-dozen occasions, a beep interrupted students' daily activities, signaling them to pull out a notebook and record their inner experience at that moment. When the researchers later coded the reports in categories, they found five common forms of inner experience (TABLE 5.1 on the next page).

- **Culture, climate, and the pace of life.** Naturalistic observation also enabled researchers to compare the pace of life in 31 countries (Levine & Norenzayan, 1999). (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).
Module 6
Correlation and Experimentation

Module Learning Objectives

Module Learning Objectives

- Describe positive and negative correlations, and explain how correlational measures can aid the process of prediction but not provide evidence of cause-effect relationships.
- Explain illusory correlations.
- Describe the characteristics of experimentation that make it possible to isolate cause and effect.

"Study finds that increased parental support for college results in lower grades" (Jaschik, 2013). "People with mental illness more likely to be smokers" (Belluck, 2013). What should we make of such news headlines—telling us that students whose parents pay the college bill tend to underachieve, and that smoking is associated with mental illness? Do these correlations indicate that students would achieve more if their parents became less supportive and that stopping smoking could produce better mental health? No. Read on.

Correlation

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. Naturalistic observations and surveys often show us that one trait or behavior is related to another. In such cases, we say the two correlate. A statistical measure (the correlation coefficient) 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 things are related: For example, how closely related are the personality scores of identical twins? How well do intelligence test scores predict career achievement? How closely is stress related to disease? In such cases, scatterplots can be very revealing.

Each dot in a scatterplot represents the values of two variables. The three scatterplots in Figure 6.1 illustrate the range of possible correlations from a perfect positive to a perfect negative. (Perfect correlations rarely occur in the “real world.”) A correlation is positive if two sets of scores, such as 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. The study of Nevada university students' inner speech discussed in Module 5 also included a correlational component. Students' reports of inner speech correlated negatively (−.36) with their scores on another measure: psychological distress. Those who reported more inner speech tended to report slightly less psychological distress.

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 heights 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 right in front of you (TABLE 6.1), can you tell whether the correlation between height and reactive temperament is positive, negative, or close to zero?

Comparing the columns in Table 6.1, most people detect very little relationship between height and temperament. In fact, the correlation in this imaginary example is positive, +0.63, as we can see if we display the data as a scatterplot. In FIGURE 6.2 on the next page, 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 temperament) tend to rise together.

If we fail to see a relationship when data are presented as systematically as in Table 6.1, how much less likely are we to notice them in everyday life? To see what is right in front of us, we sometimes need statistical illumination. We can easily see evidence of gender discrimination when given statistically summarized information about job level, seniority, performance,

<table>
<thead>
<tr>
<th>Person</th>
<th>Height in Inches</th>
<th>Temperament</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>80</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>63</td>
<td>66</td>
</tr>
<tr>
<td>3</td>
<td>61</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>79</td>
<td>90</td>
</tr>
<tr>
<td>5</td>
<td>74</td>
<td>60</td>
</tr>
<tr>
<td>6</td>
<td>69</td>
<td>42</td>
</tr>
<tr>
<td>7</td>
<td>62</td>
<td>42</td>
</tr>
<tr>
<td>8</td>
<td>75</td>
<td>60</td>
</tr>
<tr>
<td>9</td>
<td>77</td>
<td>81</td>
</tr>
<tr>
<td>10</td>
<td>60</td>
<td>39</td>
</tr>
<tr>
<td>11</td>
<td>64</td>
<td>48</td>
</tr>
<tr>
<td>12</td>
<td>76</td>
<td>69</td>
</tr>
<tr>
<td>13</td>
<td>71</td>
<td>72</td>
</tr>
<tr>
<td>14</td>
<td>66</td>
<td>57</td>
</tr>
<tr>
<td>15</td>
<td>73</td>
<td>63</td>
</tr>
<tr>
<td>16</td>
<td>70</td>
<td>75</td>
</tr>
<tr>
<td>17</td>
<td>63</td>
<td>30</td>
</tr>
<tr>
<td>18</td>
<td>71</td>
<td>57</td>
</tr>
<tr>
<td>19</td>
<td>68</td>
<td>84</td>
</tr>
<tr>
<td>20</td>
<td>70</td>
<td>39</td>
</tr>
</tbody>
</table>
gender, and salary. But we often see no discrimination when the same information dribbles in, case by case (Twiss et al., 1989). See Table 6.2 to test your understanding further.

The point to remember: A correlation coefficient, which can range from −1.0 to +1.0, reveals the extent to which two things relate. The closer the score gets to −1 or +1, the stronger the correlation.

Table 6.2
Test your understanding of correlation. Which of the following news reports are examples of a positive correlation, and which are examples of a negative correlation? (Check your answers below.)

| 1. The more children and youth used various media, the less happy they were with their lives (Kaiser, 2010). | negative |
| 2. The less sexual content teens saw on TV, the less likely they were to have sex (Collins et al., 2004). | negative |
| 3. The longer children were breast-fed, the greater their later academic achievement (Horwood & Ferguson, 1998). | positive |
| 4. The more income rose among a sample of poor families, the fewer psychiatric symptoms their children experienced (Costello et al., 2003). | negative |

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

I can almost hear someone thinking, “Well, of course, guns kill people, often in moments of passion.” If so, that could be an example of A (guns) causes B (murder). But I can hear other readers saying, “Not so fast. Maybe people in dangerous places buy more guns for self-protection—maybe B causes A.” Or maybe some third variable C causes both A and B.
Another example: Self-esteem correlates negatively with (and therefore predicts) depression. (The lower people's self-esteem, the more they are at risk for depression.) So, does low self-esteem cause depression? If, based on the correlational evidence, you assume that it does, you have much company. A nearly irresistible thinking error is assuming that an association, sometimes presented as a correlation coefficient, proves causation. But no matter how strong the relationship, it does not.

As options 2 and 3 in FIGURE 6.3 show, we'd get the same negative correlation between self-esteem and depression if depression caused people to be down on themselves, or if some third variable—such as heredity or brain chemistry—caused both low self-esteem and depression.

This point is so important—so basic to thinking smarter with psychology—that it merits one more example. A survey of over 12,000 adolescents found that the more teens feel loved by their parents, the less likely they are to behave in unhealthy ways—having early sex, smoking, abusing alcohol and drugs, exhibiting violence (Resnick et al., 1997). “Adults have a powerful effect on their children’s behavior right through the high school years,” gushed an Associated Press (AP) story reporting the finding. But this correlation comes with no built-in cause-effect arrow. The AP could as well have reported, “Well-behaved teens feel their parents’ love and approval; out-of-bounds teens more often think their parents are disapproving jerks.”

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

---

1Because 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).

---

AP® Exam Tip

Take note of how much emphasis is put on this idea. Correlation and association do not prove a cause-effect relationship.

---

Figure 6.3

Three possible cause-effect relationships

People low in self-esteem are more likely to report depression than are those high in self-esteem. One possible explanation of this negative correlation is that a bad self-image causes depressed feelings. But, as the diagram indicates, other cause-effect relationships are possible.
Illusory Correlations

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 (Trolle & 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 6.4, 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.

---

Figure 6.4
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.)

Experimentation

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

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

Researchers have found that the intelligence scores of children who were breast-fed as infants are somewhat higher than the scores of children who were bottle-fed (Angelsen et al., 2001; Mortensen et al., 2002; Quinn et al., 2001). In Britain, breast-fed babies have also been more likely than their bottle-fed counterparts to eventually move into a higher social class (Martin et al., 2007). The “breast is best” intelligence effect shrinks when researchers compare breast-fed and bottle-fed children from the same families (Der et al., 2006).
What do such findings mean? Do smarter mothers (who in modern countries more often breast feed) have smarter children? Or, as some researchers believe, do the nutrients of mother's milk contribute to brain development? To find answers to such questions—to isolate cause and effect—researchers can experiment. Experiments enable researchers to isolate the effects of one or more variables by (1) manipulating the variables of interest and (2) holding constant (“controlling”) other variables. To do so, they often create an experimental group, in which people receive the treatment, and a contrasting control group that does not receive the treatment.

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. To minimize any preexisting differences between the two groups, researchers randomly assign people to the two conditions. Random assignment effectively equalizes the two groups. If one-third of the volunteers for an experiment can wiggle their ears, then about one-third of the people in each group will be ear wiggles. So, too, with ages, attitudes, and other characteristics, which will be similar in the experimental and control groups. Thus, if the groups differ at the experiment’s end, we can surmise that the treatment had an effect.

To experiment with breast feeding, one research team randomly assigned some 17,000 Belarus newborns and their mothers either to a breast-feeding promotion group or to a normal pediatric care program (Kramer et al., 2008). At 3 months of age, 43 percent of the infants in the experimental group were being exclusively breast-fed, as were 6 percent in the control group. At age 6, when nearly 14,000 of the children were restudied, those who had been in the breast-feeding promotion group had intelligence test scores averaging six points higher than their control condition counterparts.

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

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

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

And that is precisely how investigators evaluate new drug treatments and new methods of psychological therapy (Modules 72–73). They randomly assign participants in these studies to research groups. One group receives a treatment (such as a medication). The other group receives a pseudotreatment—an inert placebo (perhaps a pill with no drug in it). The participants are often blind (uninformed) about what treatment, if any, they are receiving. If the study is using a double-blind procedure, neither the participants nor the research assistants who administer the drug and collect the data will know which group is receiving the treatment.
In such studies, researchers can check a treatment’s actual effects apart from the participants’ and the staff’s belief in its healing powers. Just thinking you are getting a treatment can boost your spirits, relax your body, and relieve your symptoms. This placebo effect is well documented in reducing pain, depression, and anxiety (Kirsch, 2010). And the more expensive the placebo, the more “real” it seems to us—a fake pill that costs $2.50 works better than one costing 10 cents (Waber et al., 2008). To know how effective a therapy really is, researchers must control for a possible placebo effect.

**Independent and Dependent Variables**

Here is a practical experiment: In a not yet published study, Victor Benassi and his colleagues gave college psychology students frequent in-class quizzes. Some items served merely as review—students were given questions with answers. Other self-testing items required students to actively produce the answers. When tested weeks later on a final exam, students did far better on material on which they had been tested (75 percent correct) rather than merely reviewed (51 percent correct). By a wide margin, testing beat restudy.

This simple experiment manipulated just one factor: the study procedure (reading answers versus self-testing). We call this experimental factor the independent variable because we can vary it independently of other factors, such as the students’ memories, intelligence, and age. 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 review versus self-testing study method in this analysis) or measure the dependent variable (final exam performance). These definitions answer the “What do you mean?” question with a level of precision that enables others to repeat the study. (See **Figure 6.5** for the previously mentioned 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, researchers sent identically worded e-mail inquiries to 1115 Los Angeles-area landlords (Carpusor & Loges, 2006). The researchers varied the ethnic connotation of the sender’s name and tracked the percentage of positive replies (invitations to view the apartment in person). “Patrick McDougall,” “Said Al-Rahman,” and “Tyrell Jackson” received, respectively, 89 percent, 66 percent, and 56 percent invitations. (In this experiment, what was the independent variable? The dependent variable?)

---

**Figure 6.5**

Experimentation To
discern causation, psychologists may randomly assign some participants to an experimental group, others to a control group. Measuring the dependent variable (intelligence score in later childhood) will determine the effect of the independent variable (whether breast feeding was promoted).
A key goal of experimental design is validity, which means the experiment will test what it is supposed to test. In the rental housing experiment, we might ask, “Did the e-mail inquiries test the effect of perceived ethnicity? Did the landlords’ response actually vary with the ethnicity of the name?”

Experiments can also help us evaluate social programs. Do early childhood education programs boost impoverished children’s chances for success? What are the effects of different antismoking campaigns? Do school sex-education programs reduce teen pregnancies? To answer such questions, we can experiment: If an intervention is welcomed but resources are scarce, we could use a lottery to randomly assign some people (or regions) to experience the new program and others to a control condition. If later the two groups differ, the intervention’s effect will be supported (Passell, 1993).

Let’s recap. A variable is anything that can vary (infant nutrition, intelligence, TV exposure—anything within the bounds of what is feasible and ethical). Experiments aim to manipulate an independent variable, measure the dependent variable, and allow random assignment to control all other variables. An experiment has at least two different conditions: an experimental condition and a comparison or control condition. Random assignment works to equate the groups before any treatment effects occur. In this way, an experiment tests the effect of at least one independent variable (what we manipulate) on at least one dependent variable (the outcome we measure). **TABLE 6.3** compares the features of psychology’s research methods.

---

1The independent variable, which the researchers manipulated, was the ethnicity-related names. The dependent variable, which they measured, was the positive response rate.

### Table 6.3 Comparing Research Methods

<table>
<thead>
<tr>
<th>Research Method</th>
<th>Basic Purpose</th>
<th>How Conducted</th>
<th>What Is Manipulated</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Descriptive</strong></td>
<td>To observe and record behavior</td>
<td>Do case studies, naturalistic observations, or surveys</td>
<td>Nothing</td>
<td>Case studies require only one participant; naturalistic observations may be done when it is not ethical to manipulate variables; surveys may be done quickly and inexpensively (compared with experiments)</td>
<td>Uncontrolled variables mean cause and effect cannot be determined; single cases may be misleading</td>
</tr>
<tr>
<td><strong>Correlational</strong></td>
<td>To detect naturally occurring relationships; to assess how well one variable predicts another</td>
<td>Collect data on two or more variables; no manipulation</td>
<td>Nothing</td>
<td>Works with large groups of data, and may be used in situations where an experiment would not be ethical or possible</td>
<td>Does not specify cause and effect</td>
</tr>
<tr>
<td><strong>Experimental</strong></td>
<td>To explore cause and effect</td>
<td>Manipulate one or more variables; use random assignment</td>
<td>The independent variable(s)</td>
<td>Specifies cause and effect, and variables are controlled</td>
<td>Sometimes not feasible; results may not generalize to other contexts; not ethical to manipulate certain variables</td>
</tr>
</tbody>
</table>
Module 7
Statistical Reasoning in Everyday Life

Module Learning Objectives

- Describe the three measures of central tendency, and discuss the relative usefulness of the two measures of variation.
- Explain how we know whether an observed difference can be generalized to other populations.

In descriptive, correlational, and experimental research, statistics are tools that help us see and interpret what the unaided eye might miss. Sometimes the unaided eye misses badly. Researchers invited 5522 Americans to estimate the percentage of wealth possessed by the richest 20 percent in their country (Norton & Ariely, 2011). Their average person's guess—58 percent—"dramatically underestimated" the actual wealth inequality. (The wealthiest 20 percent possess 84 percent of the wealth.)

The Need for Statistics

Accurate statistical understanding benefits everyone. To be an educated person today is to be able to apply simple statistical principles to everyday reasoning. One needn't memorize complicated formulas to think more clearly and critically about data.

Off-the-top-of-the-head estimates often misread reality and 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 (Module 53)?
- We ordinarily use but 10 percent of our brain. Or is it closer to 100 percent (Module 12)?
- The human brain has 100 billion nerve cells. Or is it more like 40 billion, as suggested by extrapolation from sample counts (Module 10)?

The point to remember: Doubt big, round, undocumented numbers.

Statistical illiteracy also feeds needless health scares (Gigerenzer et al., 2008, 2009, 2010). In the 1990s, the British press reported a study showing
that women taking a particular contraceptive pill had a 100 percent increased risk of blood clots that could produce strokes. This caused thousands of women to stop taking the pill, leading to a wave of unwanted pregnancies and an estimated 13,000 additional abortions (which also are associated with increased blood clot risk). And what did the study find? A 100 percent increased risk, indeed—but only from 1 in 7000 women to 2 in 7000 women. Such false alarms underscore the need to teach statistical reasoning and to present statistical information more transparently.

Descriptive Statistics

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

Once researchers have gathered their data, they may use **descriptive statistics** to organize that data meaningfully. One way to do this is to convert the data into a simple **bar graph**, called a **histogram**, as in **FIGURE 7.1**, 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 7.1a) or small (FIGURE 7.1b). 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 frequently occurring score or scores. The most commonly reported is the **mean**, or arithmetic average—the total 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.

**Figure 7.1**

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).
Measures of central tendency neatly summarize data. But consider what happens to the mean when a distribution is lopsided, or skewed, by a few way-out scores. With income data, for example, the mode, median, and mean often tell very different stories (FIGURE 7.2). 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 customers’ 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. Mean and median tell different true stories.

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

---

**Figure 7.2**

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.

---

**skewed distribution** a representation of scores that lack symmetry around their average value.

**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.

---

**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. A couple of extreme scores in an otherwise uniform group, such as the $950,000 and $1,420,000 incomes in Figure 7.2, 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 7.1). 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 the more diverse community population outside your school.

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.
### Table 7.1 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.

<table>
<thead>
<tr>
<th>Score</th>
<th>Deviation from the Mean</th>
<th>Squared Deviation</th>
<th>Score</th>
<th>Deviation from the Mean</th>
<th>Squared Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>72</td>
<td>-8</td>
<td>64</td>
<td>60</td>
<td>-20</td>
<td>400</td>
</tr>
<tr>
<td>74</td>
<td>-6</td>
<td>36</td>
<td>60</td>
<td>-20</td>
<td>400</td>
</tr>
<tr>
<td>77</td>
<td>-3</td>
<td>9</td>
<td>70</td>
<td>-10</td>
<td>100</td>
</tr>
<tr>
<td>70</td>
<td>-1</td>
<td>1</td>
<td>70</td>
<td>-10</td>
<td>100</td>
</tr>
<tr>
<td>82</td>
<td>+2</td>
<td>4</td>
<td>90</td>
<td>+10</td>
<td>100</td>
</tr>
<tr>
<td>84</td>
<td>+4</td>
<td>16</td>
<td>90</td>
<td>+10</td>
<td>100</td>
</tr>
<tr>
<td>85</td>
<td>+5</td>
<td>25</td>
<td>100</td>
<td>+20</td>
<td>400</td>
</tr>
<tr>
<td>87</td>
<td>+7</td>
<td>49</td>
<td>100</td>
<td>+20</td>
<td>400</td>
</tr>
</tbody>
</table>

Total = 640
Sum of (deviations)² = 204

Mean = 640 / 8 = 80

Standard deviation = \( \sqrt{\frac{\text{Sum of (deviations)}^2}{\text{Number of scores}}} = \sqrt{\frac{204}{8}} = 5.0 \)

Total = 640
Sum of (deviations)² = 2000

Mean = 640 / 8 = 80

Standard deviation = \( \sqrt{\frac{\text{Sum of (deviations)}^2}{\text{Number of scores}}} = \sqrt{\frac{2000}{8}} = 15.8 \)

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 7.3** shows, a useful property of the normal curve is that roughly 68% of the cases fall within one standard deviation on either side of the mean. About 95% of cases fall within two standard deviations. Thus, as Module 61 notes, about 68% of people taking an intelligence test will score within ±15 points of 100. About 95% will score within ±30 points.

![Figure 7.3 The normal curve](image)

**Figure 7.3 The normal curve** Scores on aptitude tests tend to form a normal, or bell-shaped, curve. For example, the most commonly used intelligence test, the Wechsler Adult Intelligence Scale, calls the average score 100.
Inferential Statistics

How do we know whether an observed difference can be generalized to other populations?

Data are "noisy." The average score in one group (breast-fed babies) could conceivably differ from the average score in another group (bottle-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 is not just a fluke—a chance result of your sampling? For guidance, we can ask how reliable and significant the differences are. These inferential statistics help us determine if results can be generalized to a larger population.

When Is an Observed Difference Reliable?

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

1. **Representative samples are better than biased samples.** As noted in Module 5, 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 instructors at each institution) tells friends about the "great instructors" 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:* Smart thinkers are not overly impressed by a few anecdotes. Generalizations based on a few unrepresentative cases are unreliable.

When Is a Difference Significant?

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

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 men's aggression scores, the more confidence we would have that any observed gender difference is reliable.) And when the difference between the sample averages is *large*, we have even more confidence that the difference between them reflects a real difference in their populations.

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

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

When reading about research, you should remember that, given large enough 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.

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.

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
Can you solve this puzzle?
The registrar's office at the University of Michigan has found that usually about 100 students in Arts and Sciences have perfect 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 (Jepson et al., 1983)?

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

Module 7 Review

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

- A measure of central tendency is a single score that represents a whole set of scores. Three such measures are the mode (the most frequently occurring score), the mean (the arithmetic average), and the median (the middle score in a group of data).

- Measures of variation tell us how diverse data are. Two measures of variation are the range (which describes the gap between the highest and lowest scores) and the standard deviation (which states how much scores vary around the mean, or average, score).

- Scores often form a normal (or bell-shaped) curve.
Module 8
Frequently Asked Questions About Psychology

Module Learning Objectives

8-1 Explain the value of simplified laboratory conditions in illuminating everyday life.
8-2 Discuss whether psychological research can be generalized across cultures and genders.
8-3 Explain why psychologists study animals, and describe the ethical guidelines that safeguard animal research participants.
8-4 Describe the ethical guidelines that safeguard human research participants.
8-5 Examine whether psychology is free of value judgments.

We have reflected on how a scientific approach can restrain biases. We have seen how case studies, naturalistic observations, and surveys help us describe behavior. We have also noted that correlational studies assess the association between two variables, 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

8-1 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? If, after playing violent video games in the lab, teens become more willing to push buttons that they think electrically shock someone, does this indicate that playing shooter games makes someone more likely to commit violence in everyday life?
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 researchers apply to more complex behaviors such as night flying. And many investigations show that principles derived in the laboratory do typically generalize to the everyday world (Anderson et al., 1999).

The point to remember: Psychological science focuses less on particular behaviors than on seeking general principles that help explain many behaviors. And remember: Although psychological principles may help predict behaviors for groups of people, they minimally predict behavior for any individual. Knowing students’ grade level may clue us to their average vocabulary level, but individual students’ word power will vary.

B.2 Does behavior depend on one’s culture and gender?

What can psychological studies done in one time and place—often with people from what researchers call the WEIRD (Western, Educated, Industrialized, Rich, and Democratic) cultures (Henrich et al., 2010) 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. Collectivist cultures, for example, emphasize group goals, while individualist cultures put a priority on individual goals. 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 specific learning disorder (formerly called dyslexia) exhibit the same brain malfunction whether they are Italian, French, or British (Paulesu et al., 2001).
- Variation in languages may impede communication across cultures. Yet all languages share deep principles of grammar, and people from opposite hemispheres can communicate with a smile or a frown.
- People in different cultures vary in feelings of loneliness. But across cultures, loneliness is magnified by shyness, low self-esteem, and being unmarried (Jones et al., 1985; Rokach et al., 2002).
We are each in certain respects like all others, like some others, and like no other. Studying people of all races and cultures helps us discern our similarities and our differences, our human kinship and our diversity.

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

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

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

**Ethics in Research**

**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. We humans are not like animals, we are animals, sharing a common biology. Animal experiments have therefore led to treatments for human diseases—insulin for diabetes, vaccines to prevent polio and rabies, transplants to replace defective organs.

Humans are complex. But the same processes by which we learn are present in rats, monkeys, and even sea slugs. The simplicity of the sea slug’s nervous system is precisely what makes it so revealing of the neural mechanisms of learning. Sharing such similarities, should we not respect our animal relatives? “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 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 Module 79 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, what safeguards should protect the well-being of animals in research? One survey of animal researchers gave an answer. Some 98 percent supported government regulations protecting primates, dogs, and cats, and 74 percent supported regulations providing for the humane care of rats and mice (Plous & Herzog, 2000). Many professional associations and funding agencies already have such guidelines. British Psychological Society guidelines call for housing animals under reasonably natural living conditions, with companions for social animals (Lea, 2000). American Psychological Association (APA) guidelines state that researchers must ensure the “comfort, health, and humane treatment” of animals and minimize “infection, illness, and pain” (APA, 2002). The European Parliament now mandates standards for animal care and housing (Vogel, 2010).

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

Does the image of white-coated scientists delivering electric shocks trouble you? If so, you’ll be relieved to know that most psychological studies are free of such stress. With people, blinking lights, flashing words, and pleasant social interactions are more common. Moreover, psychology’s experiments are mild compared with the stress and humiliation often inflicted by reality TV shows. In one episode of The Bachelor, a man dumped his new fiancée—on camera, at the producers’ request—for the woman who earlier had finished second (Collins, 2009).

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

Ethical principles developed by the American Psychological Association (2010), by the British Psychological Society (2009), and by psychologists internationally (Pettifor, 2004), urge researchers to (1) obtain potential participants’ informed consent, (2) protect them from physical or emotional harm and discomfort, (3) keep information about individual participants confidential, and (4) fully debrief people (explain the research afterward). Moreover, most universities (where a great deal of research is conducted) now have an ethics committee—an Institutional Review Board (IRB)—that screens research proposals and safeguards participants’ well-being.

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.

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 8.1).

Even the words we use to describe something can reflect our values. In psychology and in everyday speech, labels describe and labels evaluate: One person’s rigidity is another’s consistency. One person’s faith is another’s fanaticism. One country’s enhanced interrogation techniques, such as cold-water immersion, become torture when practiced by its enemies. Our labeling someone as firm or stubborn, careful or picky, discreet or secretive reveals our own attitudes.
Popular applications of psychology also contain hidden values. If you defer to “professional” guidance about how to live—how to raise children, how to achieve self-fulfillment, what to do with sexual feelings, how to get ahead at work—you are accepting value-laden advice. A science of behavior and mental processes can help us reach our goals. But it cannot decide what those goals should be.

If some people see psychology as merely common sense, others have a different concern—that it is becoming dangerously powerful. Is it an accident that astronomy is the oldest science and psychology the youngest? To some, exploring the external universe seems far safer than exploring our own inner universe. Might psychology, they ask, be used to manipulate people?

Knowledge, like all power, can be used for good or evil. Nuclear power has been used to light up cities—and to demolish them. Persuasive power has been used to educate people—and to deceive them. Although psychology does indeed have the power to deceive, its purpose is to enlighten. Every day, psychologists are exploring ways to enhance learning, creativity, and compassion. Psychology speaks to many of 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.

Before You Move On

▶ ASK YOURSELF

Were any of this module’s Frequently Asked Questions your questions? Do you have other questions or concerns about psychology?

▶ TEST YOURSELF

How are human and animal research participants protected?

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

Module 8 Review

8-1 Can laboratory experiments illuminate everyday life?

- Researchers intentionally create a controlled, artificial environment in the laboratory in order to test general theoretical principles. These general principles help explain everyday behaviors.

8-2 Does behavior depend on one’s culture and gender?

- Attitudes and behaviors may vary somewhat by gender or across cultures, but because of our shared human kinship, the underlying processes and principles are more similar than different.

8-3 Why do psychologists study animals, and it ethical to experiment on animals?

- Some psychologists are primarily interested in animal behavior; others want to better understand the physiological and psychological processes shared by humans and other species.

- Government agencies have established standards for animal care and housing. Professional associations and funding agencies also establish guidelines for protecting animals’ well-being.