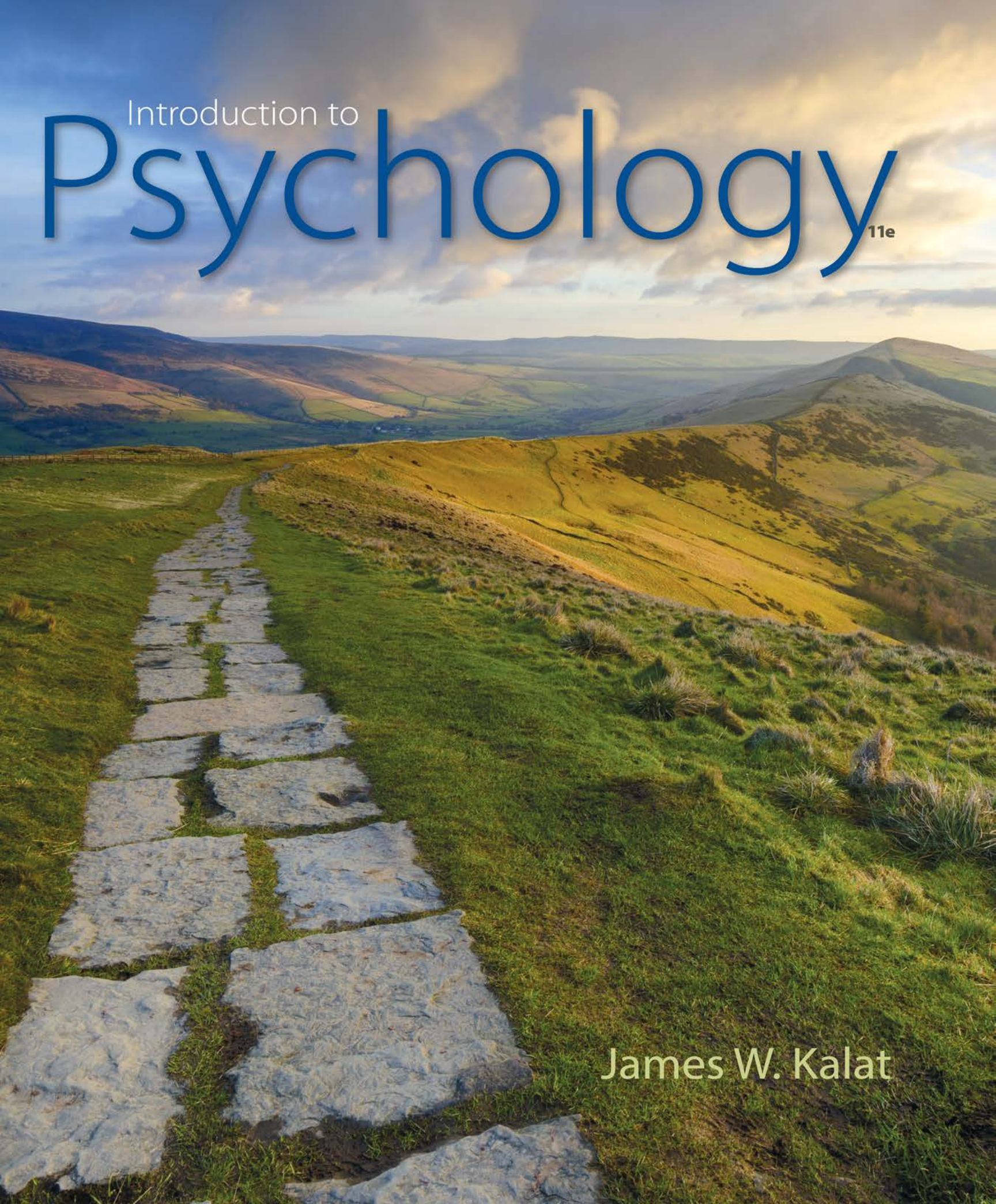
Introduction to
Psychology
11e
James W. Kalat

Introduction to Psychology 11e

James W. Kalat

North Carolina State University

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James W. Kalat

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Jo Ellen Kalat

To my grandchildren: Max and Ann Stapel-Kalat, Ophelia and Liam Floyd

about the author

JAMES W. KALAT (rhymes with ballot) is Professor Emeritus at North Carolina State University, where he taught Introduction to Psychology and Biological Psychology for 35 years. Born in 1946, he received an AB degree summa cum laude from Duke University in 1968 and a PhD in psychology in 1971 from the University of Pennsylvania, under the supervision of Paul Rozin. He is also the author of *Biological Psychology*, 12th edition (Boston, MA: Cengage, 2016), and coauthor with Michelle N. Shiota of *Emotion*, 2nd edition (Belmont, CA: Wadsworth, 2012). In addition to textbooks, he has written journal articles on taste-aversion learning, the teaching of psychology, and other topics. A remarried widower, he has three children, two stepsons, and four grandchildren. When not working on something related to psychology, his hobby is bird-watching.

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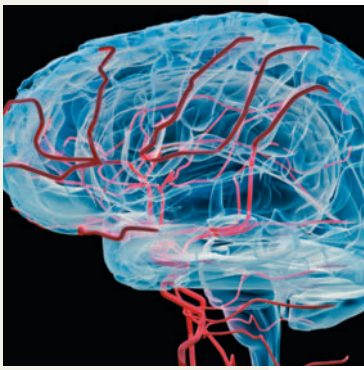

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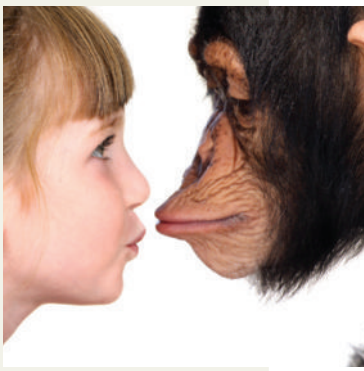

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Some years ago, I was on a plane that had to turn around shortly after takeoff because one of its two engines had failed. When we were told to get into crash position, the first thing I thought was, "I don't want to die yet! I was looking forward to writing the next edition of my textbook!" True story.

I remember taking my first course in psychology as a freshman at Duke University in 1965. Frequently, I would describe the fascinating facts I had just learned to my roommate, friends, relatives, or anyone else who would listen. I haven't changed much since then. When I read about new research or think of a new example to illustrate some point, I want to tell my wife, children, and colleagues. Psychology is fun. Although I retired from teaching after 35 years at North Carolina State University, I still volunteer to "pinch hit" when any of my colleagues are ill or out of town. I wake up in the morning and think, "Wow! I get to teach about optical illusions today!" or "Great! Today's topic is emotions!" Do professors in other fields enjoy teaching so much? Does someone in the French department wake up thinking how exciting it will be to teach about adverbs today? I doubt it.

Ideally, a course or textbook in psychology should accomplish two goals. The first is to instill a love of learning so that our graduates will continue to update their education. Even if students permanently remembered everything they learned—and of course they won't—their understanding would gradually go out of date unless they continue to learn about new developments. I hope that some of our students occasionally read *Scientific American Mind* or similar publications. The second goal is to teach students the skills of evaluating evidence and questioning assertions, so that when they do read about some new research, they will ask the right questions before drawing a conclusion. That skill can carry over to fields other than psychology.

Throughout this text, I have tried to model the habit of critical thinking or evaluating the evidence, particularly in the **What's the Evidence?** features that describe research studies in some detail. I have pointed out the limitations of the evidence and the possibilities for alternative interpretations. The goal is to help students ask their own questions, distinguish between good and weak evidence, and ultimately, appreciate the excitement of psychological inquiry.

Approaches, Features, and Student Aids

Many years ago, I read an educational psychology textbook that said children with learning disabilities and attention problems learn best from specific, concrete examples. I remember thinking, "Wait a minute. I do, too! Don't we *all* learn best from specific, concrete examples?" For this reason, science classes use laboratories to let students see for themselves. Few introductory psychology classes offer laboratories, but we can nevertheless encourage students to try procedures that require little or no equipment. At various points, the text describes simple **Try It Yourself** exercises, such as negative afterimages, binocular rivalry, encoding specificity, and the Stroop effect. Additional activities are available as **Online Try It Yourself** activities on MindTap. Students who try these activities will understand and remember the concepts far better than if they merely read about them.

Cognitive psychology researchers find that we learn more if we alternate between reading and testing than if we spend the same amount of time reading. The **Concept Checks** pose questions that attentive readers should be able to answer. Students who answer correctly can feel encouraged. Those who miss a question should use the feedback to reread the relevant passages.

Each chapter of this text is divided into two to five modules, each with its own summary. Modules provide flexibility for instructors who wish to take sections in a different order—for example, operant conditioning before classical conditioning—or who wish to omit a section. Modular format also breaks up the reading assignments so that students read one or two modules for each class. Key terms are listed at the end of each module. At the end of the text, a combined Subject Index and Glossary defines key terms and provides page references.

Education was long a traditional field in which the procedures hardly changed since the invention of chalk. Today, however, educators use the power of new technologies, and this text offers several important technological enhancements. The digital MindTap for *Introduction to Psychology* includes online Try It Yourself exercises as well as an integrated eBook, videos with assessment, mastery training, validated essay assignments, quizzes, and an online glossary.

What's New in the Eleventh Edition?

Anyone familiar with previous editions will notice two changes in the format: A list of learning objectives starts each module, and a few multiple-choice review questions end each module.

This edition has more than 600 new references, including more than 500 from 2012 or later. Nearly every topic in the book has at least a minor revision or update. The three modules of Chapter 2 were combined into two, and the first module of Chapter 10 was substantially reorganized. A few new topics were added, including social neuroscience, individual differences in taste and smell, and how to take notes in class. Many topics were substantially revised, including replicability, epigenetics, and autism. Many of the figures are new or revised. Here are a few of my favorite new studies:

- Hearing loss in old age occurs not only in the ears, but also in the brain. A decrease of inhibitory synapses makes it harder to attend to one voice among many, and the auditory cortex may deteriorate from insufficient input, such as when someone delays getting hearing aids. (Chapter 4)
- The "collectivist attitude" typical of Asian cultures is stronger in some parts of China than others, and correlates strongly with a history of rice farming. Unlike wheat farming, rice farming requires extensive cooperation among neighboring farmers. (Chapter 5)
- In contrast to the previous view that expertise results from 10,000 hours of practice, new research clearly demonstrates important individual differences. Some chess players reach expert levels after only 3,000 hours of practice, whereas others fail to achieve expertise after 25,000 hours. (Chapter 8)
- The brain mechanisms for self-initiated ("spontaneous") movements differ from those for stimulus-elicited movements, and self-initiated movements almost always have a slow, gradual onset. That finding is critical for interpreting Libet's study reporting that brain activity for a muscle movement starts before a conscious decision to move. The problem is that a conscious decision for a spontaneous movement, like the movement itself, is gradual and hard to pinpoint in time. (Chapter 10)
- People at an all-you-can-eat buffet tend to eat until they think they got their money's worth. People given a half-off coupon to a pizza buffet ate less than others did, on average. (Chapter 11)
- People with anorexia nervosa seldom experienced depression or any other psychological troubles prior to becoming anorexic, and treating them for depression is generally ineffective in relieving anorexia. A new study starts with the assumption that the decreased eating is the original problem, and that the increased activity characteristic of anorexia is an unconscious attempt for temperature control. (Chapter 11)
- Sex hormones influence the differentiation of several brain areas, but the chemical mechanisms differ from one brain area to another. Therefore, it is common for a person to be more masculinized or more feminized in one brain area than another, just as someone can be behaviorally more male-typical in some ways and more female-typical in others. (Chapter 11)
- A woman with damage to her amygdala previously seemed unable to experience fear or anxiety. A new study shows that she feels intense anxiety in response to breathing concentrated carbon dioxide. The amygdala damage doesn't prevent fear; it just blocks processing cognitive information relating to fear. (Chapter 12)
- More recent birth cohorts report greater life satisfaction than older birth cohorts, at all ages. (Chapter 12)
- Love doesn't always fade over time. Many older couples continue to experience passionate love. (Chapter 13)

Teaching and Learning Supplements

You're familiar with those television advertisements that offer something, usually for $19.95, and then say, "But wait, there's more!" Same here. In addition to the text, the publisher offers many supplements:

MindTap

MindTap for *Introduction to Psychology,* 11th edition, creates a unique learning path that fosters increased comprehension and efficiency. It engages students and empowers them to produce their best work—consistently. In MindTap, course material is seamlessly integrated with videos, activities, apps, and more.

In MindTap instructors can:

- control the content. Instructors select what students see and when they see it.
- create a unique learning path. In MindTap, the *Introduction to Psychology* text is enhanced with multimedia and activities to encourage and motivate learning and retention, moving students up the learning taxonomy. Materials can be used

as-is or modified to match exactly with an instructor's syllabus.
- integrate their own content. Instructors can modify the MindTap Reader using their own documents or pulling from sources like RSS feeds, YouTube videos, websites, Google Docs, and more.
- follow student progress. Powerful analytics and reports provide a snapshot of class progress, time students spend logging into the course, and completion to help instructors assess level of engagement and identify problem areas.

Test Bank, powered by Cognero Instant Access. Written by the author himself, the test bank for *Introduction to Psychology* consists entirely of new or reworded items, with an emphasis on clarity. Nearly all items are worded in the form of a question, and none of them include an "all of the above" or "none of the above" choice. The test bank also includes a special file of items that cut across chapters, intended for inclusion on a comprehensive final exam. That bank is also available in Cognero electronic format.

Online Instructor's Resource Manual is both thorough and creative. It includes suggestions for class demonstrations and lecture material, organized by chapter to allow instructors to easily identify resources to enhance lectures and facilitate learning.

Online PowerPoint® Lecture slide decks are designed to facilitate instructors' use of PowerPoint® in lectures. Slides are provided for each chapter, and contain main concepts, with figures, graphics, and tables to visually illustrate main points from the text. The notes section of the slide provides guidelines and text references to support lecture preparation. Slides have been designed to be easily modifiable for instructors to customize with their own materials.

Acknowledgments

To begin the job of writing a textbook, a potential author needs self-confidence bordering on arrogance and, to complete it, the humility to accept criticism of favorite ideas and carefully written prose. A great many people provided helpful suggestions that made this a far better text than it would have been without them.

My acquisitions editor, Clayton Austin, has been very helpful and supportive throughout the preparation of this edition. I have been delighted to work with Michelle Newhart, my developmental editor, who provided helpful, intelligent advice on everything from the big picture to the details. I thank them for their tireless help.

I greatly appreciate the detailed work of the copy editor, Heather McElwain. Jill Traut and Samen Iqbal did a marvelous job of supervising the production, a complicated task with a book such as this. Vernon Boes, the art director, and Jeanne Calabrese, who designed the cover and interior, had the patience and artistic judgment to counterbalance this very nonartistic author. Andrew Ginsberg planned and executed the marketing strategies. The photo and text researchers at Lumina Datamatics skillfully researched and managed the permissions requests. To each of these, my thanks and congratulations.

My wife, Jo Ellen Kalat, not only provided support and encouragement but also listened to my attempts to explain concepts and offered many helpful suggestions and questions. I thank my department head, Douglas Gillan, my North Carolina State colleagues, and Jack Huber from Meredith College, for their helpful suggestions.

Many reviewers provided helpful and insightful comments. Each edition builds on contributions from reviewers of previous editions. I would like to thank the following reviewers who contributed their insight to one or more editions:

Jennifer Ackil, Gustavus Adolphus College; Jeffrey Adams, Trent University; Judi Addelston, Valencia College; Mark Affeltranger, University of Pittsburgh; Catherine Sanderson, Amherst College; Susan Anderson, University of South Alabama; Bob Arkin, Ohio State University; Melanie M. Arpaio, Sussex County Community College; Susan Baillet, University of Portland; Cynthia Bane, Denison University; Joe Bean, Shorter University; Mark Bodamer, Gonzaga University; Richard W. Bowen, Loyola University Chicago; Rebecca Brand, Villanova University; Michael Brislawn, Bellevue College; Delbert Brodie, St. Thomas University; John Broida, University of Southern Maine; Thomas Brothen, University of Minnesota; Gordon Brown, Pasadena City College; Gregory Bushman, Beloit College; James Calhoun, University of Georgia; Bernardo Carducci, Indiana University Southeast; Thomas Carskadon, Mississippi State University; Mark Casteel, Pennsylvania State University, York Campus; Liz Coccia, Austin Community College; Carolyn Cohen, Northern Essex Community College; Karen Couture, Keene State College; Alex Czopp, Western Washington University; Deana Davalos, Colorado State University; Patricia Deldin, University of Michigan; Katherine Demitrakis, Central New Mexico Community College; Janet Dizinno, St. Mary University; Alicia M. Doerflinger, Marietta College; Karen Douglas, San Antonio College–Alamo Colleges; Kimberly Duff, Cerritos College; Darlene Earley-Hereford, Southern Union State Community College; David J. Echevarria, University of Southern Mississippi; Vanessa Edkins, University of Kansas;

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James W. Kalat

Welcome to introductory psychology! I hope you will enjoy reading this text as much as I enjoyed writing it. I have tried to make this book as interesting and as easy to study as possible.

Features of This Text

Modular Format

Each chapter is divided into two or more modules so that you can study a limited section at a time. Each chapter begins with a table of contents and a list of learning objectives. At the end of each module is a summary of important points, a list of key terms, and a few multiple-choice questions. Although the multiple-choice questions are listed at the end, you may find it a good strategy to try answering them before you read the module. Trying the questions at the start will prime you to pay attention to those topics. Do not assume that the summary points and the review questions include everything you should learn! They are only a sampling.

Key Terms

When an important term first appears in the text, it is highlighted in **boldface** and defined in *italics*. All the boldface terms are listed alphabetically at the end of each module. They appear again with definitions in the combined Subject Index and Glossary at the end of the book. You might want to find the Subject Index and Glossary right now and familiarize yourself with it.

I sometimes meet students who think they have mastered the course because they have memorized the definitions. The title of the course is "psychology," not "vocabulary." You do need to understand the defined words, but don't memorize the definitions word for word. It would be better to try to think of examples of each term. Better yet, when appropriate, think of evidence for or against the concept that the term represents.

Questions to Check Your Understanding

People remember material better if they alternate between reading and testing than if they spend the whole time reading. (We'll consider that point again in the chapter on memory.) At various points in this text are Concept Checks, questions that ask you to use or apply the information you just read. Try to answer each of them before reading the answer. If your answer is correct, you can feel encouraged. If it is incorrect, you should reread the section. In MindTap, Mastery Training is an adaptive tool that allows you to practice concepts over time. As you practice, questions adjust to focus on the items where you need the most review. Reminders help you optimize studying by reviewing at times when it will be most beneficial.

Try It Yourself Activities

The text includes many items marked "Try It Yourself." Most of these can be done quickly with little or no equipment. Online Try It Yourself activities are also available on MindTap. These are like the Try It Yourself activities in the text, except that they include sounds and motion. The description of a psychological principle will be easier to understand and remember after you have experienced it yourself.

"What's the Evidence?" Features

With the exception of the introductory chapter, every chapter includes a section titled "What's the Evidence?" These features highlight research studies in more detail, specifying the hypothesis (idea being tested), research methods, results, and interpretation. In some cases, the discussion also mentions the limitations of the study. These sections provide examples of how to evaluate evidence.

MindTap

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- MindTap delivers real-world relevance with activities and assignments designed to help students build critical thinking and analytical skills that can be applied to other courses and to their professional lives.
- MindTap serves as a single destination for all course materials, so students stay organized and efficient, and have the necessary tools to master the content.

- MindTap shows students where they stand at all times—both individually and compared to the highest performers in class. This information helps to motivate and empower performance.

Indexes and Reference List

A section at the back of the book lists the references cited in the text in case you want to check something for more details. The combined Subject Index and Glossary defines key terms and indicates where in the book to find more information. The name index provides the same information for all names mentioned in the text.

Answers to Some Frequently Asked Questions

Do you have any useful suggestions for improving study habits? Whenever students ask me why they did badly on the last test, I ask, "When did you read the assignments?" The typical answer is that they read everything the night before the test. If you want to learn the subject matter well, read the assigned material before the lecture, review it again after the lecture, and quickly go over it again a few days later. Then reread the textbook assignments and your lecture notes before a test. Memory researchers have established that you will understand and remember something better by studying it several times spread out over days than by studying the same amount of time all at once. Also, of course, the more total time you spend studying, the better.

When you study, don't just read the text but stop and think about it. The more actively you use the material, the better you will remember it. One way to improve your studying is to read by the SPAR method: **S**urvey, **P**rocess meaningfully, **A**sk questions, **R**eview.

Survey: Know what to expect so that you can focus on the main points. When you start a module, first look over the learning objectives. It also helps if you turn to the end and read the summary and try to answer the review questions.

Process meaningfully: Read the chapter carefully, stopping to think from time to time. Tell your roommate something you learned. Think about how you might apply a concept to a real-life situation. Pause when you come to the Concept Checks and try to answer them. Do the Try It Yourself exercises. Try to monitor how well you understand the text and adjust your reading accordingly. Good readers read quickly through easy, familiar content but slowly through difficult material.

Ask questions: When you finish the chapter, try to anticipate what questions your instructor would ask on a test. What questions would you ask, if you were the professor? Write out the questions, think about them, and hold them for later.

Review: Pause for at least an hour, preferably a day or two. Now return to your questions and try to answer them. Check your answers against the text. Reinforcing your memory a day or two after you first read the chapter will help you retain the material longer and deepen your understanding. If you study the same material several times at lengthy intervals, you increase your chance of remembering it long after the course is over.

What do those parentheses mean, as in "(Ferguson, 2013)"? Am I supposed to remember the names and dates? Psychologists generally cite references in the text in parentheses rather than in footnotes. "(Ferguson, 2013)" refers to an article written by Ferguson, published in 2013. All the references cited in the text are listed in alphabetical order (by the author's last name) in the References section at the back of the book. You will also notice a few citations that include two dates separated by a slash, such as "(Wundt, 1862/1961)." This means that Wundt's document was originally published in 1862 and was republished in 1961. No, you should not memorize the parenthetical source citations. They are provided so interested readers can look up the source of a statement and check for further information. The names that *are* worth remembering, such as B. F. Skinner, Jean Piaget, and Sigmund Freud, are emphasized in the discussion itself.

Can you help me read and understand graphs? You will encounter four kinds of graphs in this text: pie graphs, bar graphs, line graphs, and scatter plots. Let's look at each kind.

A pie graph shows the components of a whole. Figure 1 shows the proportion of psychologists who work in various settings. It shows that many are self-employed, almost as many work in colleges and other educational institutions, and a slightly smaller number work in hospitals and other health care institutions.

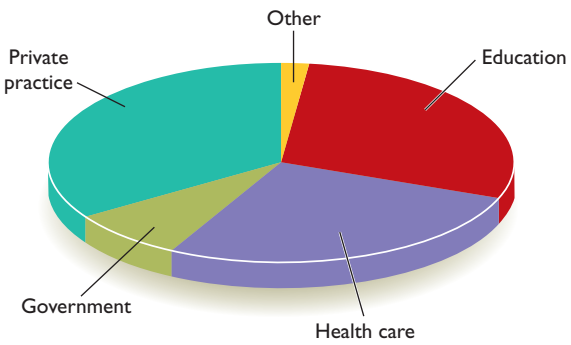

Figure 1

Bar graphs show measurements for two or more groups. Figure 2 shows how much unpleasantness three groups of women reported while they were waiting for a painful shock. The unpleasantness was least if a woman could hold her husband's hand while waiting, intermediate if she held a stranger's hand, and most if she was by herself.

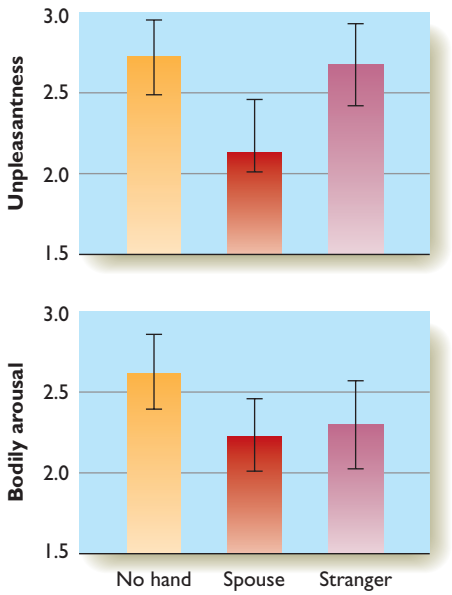

Figure 2

Line graphs show how one variable relates to another variable. Figure 3 shows measurements of conscientiousness in people from age 10 to 80. The upward slope of the line indicates that older people tend to be more conscientious than younger people, on average.

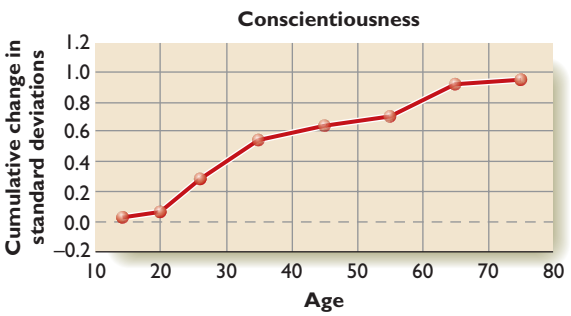

Figure 3

Scatter plots are similar to line graphs, with this difference: A line graph shows averages, whereas a scatter plot shows individual data points. By looking at a scatter plot, we can see how much variation occurs among individuals.

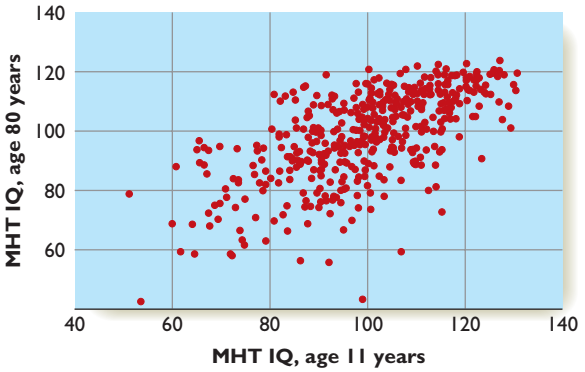

Figure 4

To prepare a scatter plot, we make two observations about each individual. In Figure 4, each person is represented by one point. If you take that point and scan down to the *x*-axis, you find that person's score on an IQ test at age 11. If you then scan across to the *y*-axis, you find that person's score on a similar test at age 80. You can see about how consistent most people's scores are over a lifetime.

We may have to take multiple-choice tests on this material. How can I do better on those tests?

1. Read each choice carefully. Do not choose the first answer that looks correct; first make sure that the other answers are wrong. If two answers fit with what you know, decide which of the two is better.
2. If you don't know the correct answer, make an educated guess. An answer that includes absolute words such as "always" or "never" is probably wrong. Also eliminate any answer that includes unfamiliar terms. If you have never heard of something, it is probably not the right answer. Remember, every test question is about something presented either in lecture or in the text.

3. After you finish, don't be afraid to go back and reconsider your answers. Students have been telling each other for decades that "you should stick with your first answer," but research says that most people who change their answers improve their scores. When you examine a question a second time, you sometimes discover that you misunderstood it the first time.

Last Words Before We Start . . .

Most of all, I hope you enjoy the text. I have tried to include the liveliest examples I can find. The goal is not just to teach you some facts but also to teach you a love of learning so that you will continue to read more and educate yourself about psychology long after your course is over.

James W. Kalat

1 What Is Psychology?

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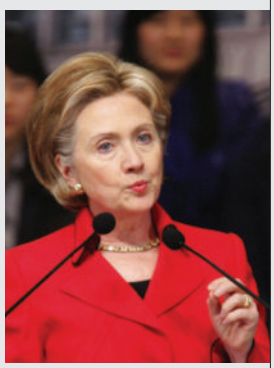

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Even when the people we trust seem very confident of their opinions, we should examine their evidence or reasoning.

If you are like most students, you start off assuming that nearly everything you read in your textbooks and everything your professors tell you must be true. What if it isn't? Suppose impostors have replaced your college's faculty. They pretend to know what they are talking about and they all vouch for one another's competence, but in fact, they are all unqualified. They managed to find textbooks that support their prejudices, but those textbooks are full of false information, too. If so, how would you know?

While we are entertaining such skeptical thoughts, why limit ourselves to colleges? When you read books and magazines or listen to political commentators, how do you know who has the right answers?

No one has the right answers all of the time. One professor starts his first day of class by saying, "At least 10 percent of what I tell you will be wrong. But I don't know which 10 percent it is." Sometimes even the best and most conscientious individuals discover to their embarrassment that a confident opinion was wrong. I don't mean to imply that you should disregard everything you read or hear. But you should expect people to tell you the reasons for their conclusions, so that you can decide which ones to follow with high confidence and which to treat as little better than a guess.

You have just encountered the theme of this book: Evaluate the evidence. You will hear all sorts of claims concerning psychology, as well as medicine, politics, religion, and other fields. Some are valid, some are wrong, some are hard to evaluate for sure, many are valid under certain conditions, and some are too vague to be either right or wrong. When you finish this book, you will be in a better position to examine evidence and decide which claims to take seriously.

module 1.1

Psychologists' Goals

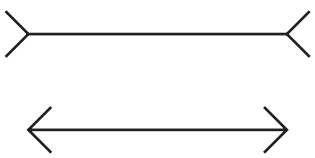
After studying this module, you should be able to:

- Discuss three major philosophical issues important to psychology.
- Distinguish psychology from psychiatry and psychoanalysis.
- Give examples of specializations in psychology, for both research and practice.

Your history text probably doesn't spend much time discussing what the term *history* means, and I doubt that a course on English literature spends the first day defining literature. Psychology is different because so many people have misconceptions about this field. I remember a student who asked when we would get to the kind of psychology he could "use on" people. Another young man bluntly asked me (in my office, not publicly) whether I could teach him tricks to seduce his girlfriend. I told him that (1) psychologists don't try to trick people into doing something against their better judgment, (2) if I did know tricks like that, ethically I couldn't tell him about them, and (3) if I knew powerful tricks to control behavior *and* I had no ethics, I would probably use those powers for my own profit instead of teaching introduction to psychology!

The term *psychology* derives from the Greek roots *psyche,* meaning "soul" or "mind," and *logos,* meaning "word." Psychology is literally the study of the mind or soul, and people defined it that way until the early 1900s. Around 1920, psychologists became disenchanted with the idea of studying the mind. First, research deals with what we observe, and mind is unobservable. Second, talking about "the mind" implies it is a thing or object. Mental activity is a process. It is not like the river but like the flow of the river; not like the automobile but like the movement of the automobile. Beginning in the early 1900s, psychologists defined their field as the study of behavior.

Certainly the study of behavior is important, but is behavior the only thing we care about? When you look at this optical illusion and say that the horizontal part of the top line looks longer than that of the bottom line (although really they are the same length), we wonder why the line *looks* longer, not just why you *said* it looks longer. So as a compromise, let's define **psychology** as *the systematic study of behavior and experience.* The word *experience* lets us discuss your perceptions without implying that a mind exists independently of your body.



When most people think of psychologists, they think of clinical psychologists—those who try to help worried, depressed, or otherwise troubled people. Clinical psychology is only one part of psychology. Psychology also includes research on sensation and perception, learning and memory, hunger and thirst, sleep, attention, child development, and more. Perhaps you expect that a course in psychology will teach you to "analyze" people and decipher hidden aspects of their personality. It will not. You will learn to understand many aspects of behavior, but you will gain no dazzling powers. Ideally, you will become more skeptical of those who claim to analyze people's personality from small samples of their behavior.

General Points about Psychology

Let's start with three of the most general statements about psychology. Each of these will arise repeatedly throughout this text.

"It Depends"

Hardly anything is true about the behavior of all people all the time. Almost every aspect of behavior depends on age. Infants differ from children, who differ from young adults, who differ from older adults. Behavior also varies with people's genetics, health, past experiences, and whether they are currently awake or asleep. In some ways, behavior differs between males and females or from one culture to another. Some aspects depend on the time of day, the temperature of the room, or how recently someone ate. How someone answers a question depends on the exact wording of the question, the wording of the previous question, and who is asking the questions.

If psychology regards "it depends" as a general truth, you may infer that psychology really doesn't know anything. On the contrary, "it depends" is a serious point. The key is to know *what* it depends on. The further you pursue your studies of psychology, the more you will become attuned to the wealth of subtle influences that people easily overlook. Here is an example: Decades ago, two psychology laboratories were conducting similar studies on human learning but reporting contradictory results. Both researchers were experienced and highly respected, they thought they were following the same procedures, and they did not understand why their results differed. Eventually, one of them traveled to the other's university to watch the other in action. Almost immediately, he noticed a key difference in procedure: the chairs in which the participants sat! His colleague at the other university had obtained chairs from a retired dentist. So the research participants were sitting in *dentist's* chairs, during an era when dental procedures were often painful. The participants were sitting there in a state of heightened anxiety, which altered their behavior (Kimble, 1967).

Progress Depends on Good Measurement

Nobel Prize–winning biologist Sydney Brenner was quoted as saying, "Progress in science depends on new techniques, new discoveries, and new ideas, probably in that order" (McElheny, 2004, p. 71). In any field, from astronomy to zoology, new discoveries and ideas depend on good measurements. Psychologists' understanding has advanced fastest on topics such as sensory processes, learning, and memory, which researchers can measure fairly accurately. Research progress has been slower in such areas as emotion and personality, where we struggle to find clear definitions and accurate measurements. As you proceed through this text, you will note occasional issues such as, "How well do IQ scores really measure intelligence?" or "Are people as happy as they say they are?" Areas of psychology with less certain measurement have less definite conclusions and slower progress.

Confidence in the Conclusions Should Depend on the Strength of the Evidence

Is it all right for young children to spend many hours a day watching television? How much is too much? Is it sometimes all right to spank a child? What should be the limits, if any, on teenagers playing violent video games? To what extent do the behavioral differences between men and women reflect biological influences? You probably have opinions on these questions, and so do many psychologists. However, in many cases, the evidence is not nearly as strong as the confident opinions imply (Ferguson, 2013). It is important to distinguish between opinions based on strong evidence and those based on less. When this text describes research studies in some detail, the reason is to give you an idea of how strong the research evidence is (or isn't) behind some conclusion.

Major Philosophical Issues in Psychology

Psychology began in the late 1800s as an attempt to apply scientific methods to certain questions of the philosophy of mind. Three of the most profound philosophical questions related to psychology are free will versus determinism, the mind–brain problem, and the nature–nurture issue.

Free Will versus Determinism

The scientific approach to anything, including psychology, assumes that we live in a universe of cause and effect. If things "just happen" for no reason at all, then we have no hope of discovering scientific principles. That is, scientists assume **determinism**, *the idea that everything that happens has a cause, or determinant, that someone could observe or measure.* This view is an assumption, not a certainty, but the success of scientific research attests to its value.

Rick Doyle/ CORBIS

Behavior is guided by external forces, such as waves, and by forces within the individual. According to the determinist view, even those internal forces follow physical laws.

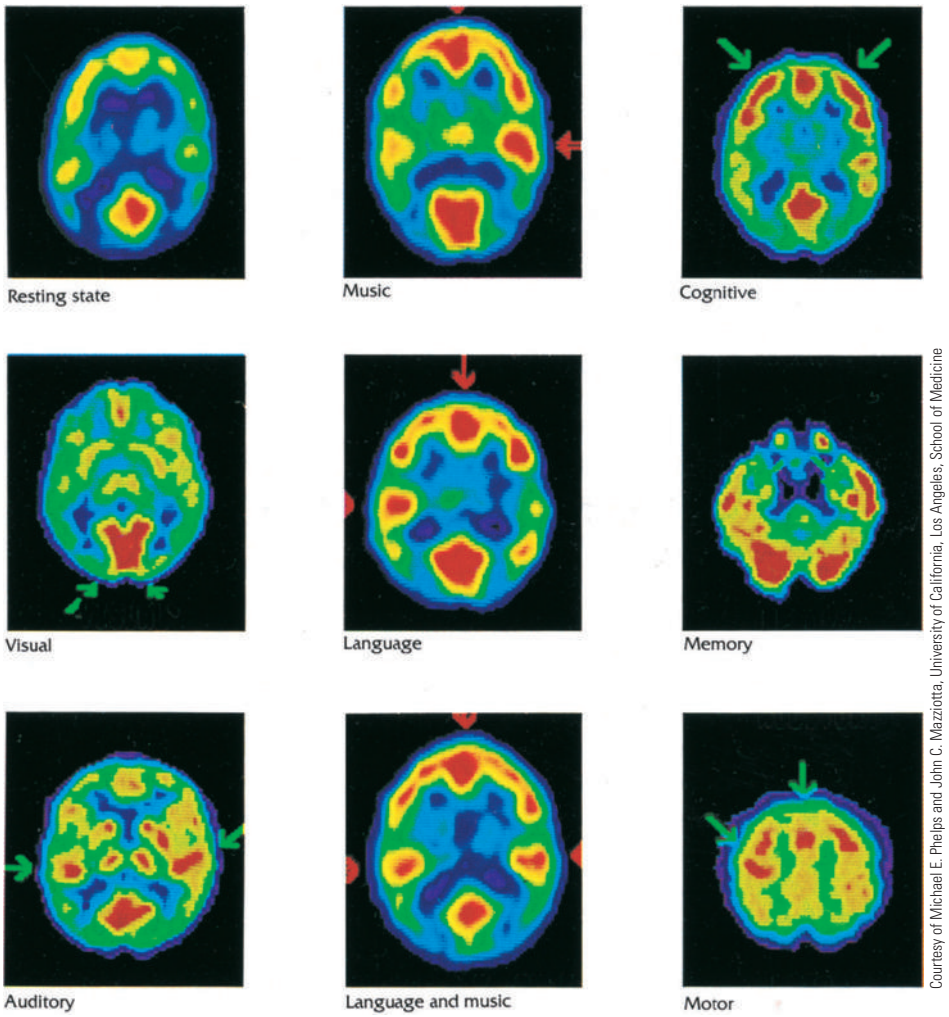
Does it apply to human behavior? We are, after all, part of the physical world. According to the determinist assumption, everything we do has causes. This view seems to conflict with the impression all of us have that "I make the decisions about my actions. Sometimes, when I am making a decision, like what to eat for lunch or which sweater to buy, I am in doubt right up to the last second. The decision could have gone either way." *The belief that behavior is caused by a person's independent decisions* is known as **free will**. Do you think your behavior is predictable? How about other people's behavior? Questionnaires show that most people think their own behavior is less predictable than other people's. That is, you think you have free will, but other people, not so much (Pronin & Kugler, 2010).

Some psychologists maintain that free will is an illusion (Wegner, 2002): What you call a conscious intention is more a prediction than a cause of your behavior. When you have the experience of deciding to move a finger, the behavior has already started to happen, controlled unconsciously. We shall explore the evidence for this idea later, in Chapter 10.

Other psychologists and philosophers reply that you do make decisions, in the sense that something within you initiates the action (Baumeister, 2008). When a ball bounces down a hill, its motion depends on the shape of the hill. When you run down a hill, you could change direction if you saw a car coming toward you, or a snake lying in your path. The ball could not.

Nevertheless, the "you" that makes your decisions is itself a product of your heredity and the events of your life. (You did not create yourself.) In a sense, yes, you have a will, an ability to make choices (Dennett, 2003). But your will is the product of your heredity and experiences. It did not emerge from nothing. Whether you do or do not have free will depends on what you mean by "free."

The test of determinism is ultimately empirical: If everything you do has a cause, your behavior should be predictable. Behavior is clearly predictable in some cases, such as reflexes. However, ordinarily psychologists' predictions are more like predicting the weather. The predictions are nearly accurate most of the time, but they cannot be accurate in every detail, simply because so many small influences are operating.



Courtesy of Michael E. Phelps and John C. Mazziotta, University of California, Los Angeles, School of Medicine

◀ **Figure 1.1** These PET scans show the brain activity of normal people during different activities. Red indicates the highest activity, followed by yellow, green, and blue. Arrows indicate the most active areas.

Researchers admit one point: Although determinism makes sense theoretically and leads to good research, it doesn't work well as a philosophy of life. One study provides a good illustration of this point: Psychologists asked people to read one of two passages. Some read an argument for determinism, and others read a paper on an irrelevant topic. The participants were then put in a situation in which it would be easy to cheat to gain a personal advantage. A higher percentage of those who had read the determinism essay cheated (Vohs & Schooler, 2008). Apparently, they felt less sense of personal responsibility.

The Mind–Brain Problem

Given that we live in a universe of matter and energy, what, if anything, is the mind? And why does consciousness exist? The *philosophical question of how experience relates to the brain* is the **mind–brain problem** (or mind–body problem). One view, called **dualism,** holds that *the mind is separate from the brain but somehow controls the brain and therefore the rest of the body.* However, dualism contradicts the law of conservation of matter and energy, one of the cornerstones of physics. According to that principle, the only way to influence any matter or energy, including the matter and energy that compose your body, is to act on it with other matter or energy. If the mind isn't composed of matter or energy, it cannot *do* anything. For that reason, nearly all brain researchers and philosophers favor **monism**, *the view that conscious experience is inseparable from the physical brain.* That is, mental activity *is* brain activity. So far as we can tell, consciousness cannot exist without brain activity, and presumably it is also true that certain kinds of brain activity cannot exist without consciousness. The mind–brain problem inspires much research, some of which we shall consider in Chapter 3 on the brain and Chapter 10 on consciousness.

The photos in ▲ **Figure 1.1** show brain activity while a person participated in nine tasks, as measured by a technique called positron-emission tomography (PET). Red indicates the highest degree of brain activity, followed by yellow, green, and blue. As you can see, the various tasks increased activity in different brain areas, although all areas showed some activity at all times (Phelps & Mazziotta, 1985). You might ask: Did the brain activity cause the thoughts, or did the thoughts cause the brain activity? Most brain researchers reply, "Neither," because brain activity and mental activity are the same thing.

Even if we accept this position, we are still far from understanding the mind–brain relationship. What type of brain activity is associated with consciousness? Why does conscious experience exist at all? Could a brain get along without consciousness? Research studies are not about to put philosophers out of business, but results do constrain the philosophical answers that we can seriously consider.

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Lawrence Manning/Corbis

Why do different children develop different interests? They had different hereditary tendencies, but they also had different experiences. Separating the roles of nature and nurture is difficult.

The Nature–Nurture Issue

Why do most little boys spend more time than little girls with toy guns and trucks and less time with dolls? Is it because of biological differences or because parents rear their sons and daughters differently?

Alcohol abuse is common in some cultures and rare in others. Are these differences entirely a matter of social custom, or do genes influence alcohol use also?

Certain psychological disorders are more common in large cities than in small towns and in the countryside. Does life in crowded cities cause psychological disorders? Or do people develop such disorders because of a genetic predisposition and then move to big cities in search of jobs, housing, and welfare services?

Each of these questions relates to the **nature–nurture issue** (or heredity–environment issue): *How do differences in behavior relate to differences in heredity and environment?* The nature–nurture issue shows up in various ways throughout psychology, and it seldom has a simple answer.

concept check

1. **What is meant by determinism?**
2. **What type of evidence supports monism?**

Answers

1. Determinism is the assumption that everything that happens has a cause.
2. Every type of mental activity is associated with some type of measurable brain activity. Also, as discussed in Chapter 3, any type of brain damage leads to a deficit in some aspect of behavior or experience.

What Psychologists Do

We have considered some major philosophical issues related to psychology in general. However, most psychologists deal with smaller, more manageable questions. They work in many occupational settings, as shown in ▼ **Figure 1.2.** The most common settings are colleges and universities, private practice, hospitals and mental health clinics, and government agencies.

Service Providers to Individuals

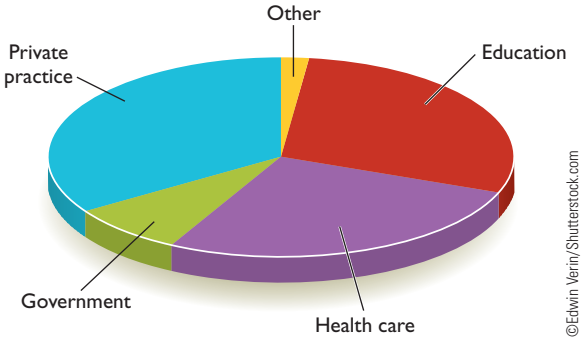
It is important to distinguish between several types of mental health professionals. Some of the main kinds of service providers for people with psychological troubles are clinical psychologists, psychiatrists, social workers, and counseling psychologists.

Clinical Psychology

Clinical psychologists *have an advanced degree in psychology (master's degree, doctor of philosophy [PhD], or doctor of psychology [PsyD]), with a specialty in understanding and helping people with psychological problems.* Those problem range from depression, anxiety, and substance abuse to marriage conflicts, difficulties making decisions, or even the feeling that "I should be getting more out of life." Clinical psychologists try, in one way or another, to understand why a person is having problems and then help that person overcome the difficulties. Some clinical psychologists are college professors and researchers, but most are full-time practitioners. A little over half of all new PhDs are for specialists in clinical psychology or other health-related fields.

Psychiatry

Psychiatry is a *branch of medicine that deals with emotional disturbances.* To become psychiatrists, students first earn a medical doctor (MD) degree and then take an additional four years of residency training in psychiatry. Because psychiatrists are medical doctors, they can prescribe drugs, such as antidepressants, whereas most psychologists cannot. In the United States, a few states now permit psychologists with a couple years of additional training to prescribe drugs.



▲ **Figure 1.2** Psychologists work in a variety of settings. (Based on data from U.S. Department of Labor, 2008)

More psychiatrists than clinical psychologists work in mental hospitals, and psychiatrists more often treat clients with severe disorders.

Does psychiatrists' ability to prescribe drugs give them an advantage over psychologists in places where psychologists cannot prescribe them? Not always. Drugs can be useful, but relying heavily on them can be a mistake. Whereas a typical visit to a clinical psychologist includes an extensive discussion of the client's troubles, many visits to a psychiatrist focus mainly on checking the effectiveness of a drug and evaluating its side effects. A survey found that over the years, fewer and fewer psychiatrists have been providing talk therapy (Mojtabai & Olfson, 2008).

Other Mental Health Professionals

Several other kinds of professionals also provide help and counsel. **Psychoanalysts** are *therapy providers who rely heavily on the theories and methods pioneered by the early 20th-century Viennese physician Sigmund Freud and later modified by others.* Freud and his followers attempted to infer the hidden, unconscious, symbolic meaning behind people's words and actions, and psychoanalysts today continue that effort.

There is some dispute about who may rightly call themselves psychoanalysts. Some people apply the term to anyone who attempts to uncover unconscious thoughts and feelings. Others apply the term only to graduates of an institute of psychoanalysis, a program that lasts four years or more. These institutes admit mostly people who are already either psychiatrists or clinical psychologists. Thus, people completing psychoanalytic training will be at least in their mid 30s.

A **clinical social worker** *is similar to a clinical psychologist but with different training.* In most cases, a clinical social worker has a master's degree in social work with a specialization in psychological problems. Many health maintenance organizations (HMOs) steer most of their clients with psychological problems toward clinical social workers instead of psychologists or psychiatrists because the social workers, with less formal education, charge less per hour.

Table 1.1 Mental Health Professionals

Type of Therapist	Education
clinical psychologist	PhD with clinical emphasis or PsyD plus internship. Ordinarily, 5+ years after undergraduate degree.
psychiatrist	MD plus psychiatric residency. Total of 8 years after undergraduate degree.
psychoanalyst	Psychiatry or clinical psychology plus 4 or more years in a psychoanalytic institute. Many others who rely on Freudian methods also call themselves psychoanalysts.
psychiatric nurse	From 2-year (AA) degree to master's degree plus supervised experience.
clinical social worker	Master's degree plus 2 years of supervised experience.
counseling psychologist	PhD, PsyD, or EdD plus supervised experience in counseling.
forensic psychologist	Doctorate, ordinarily in clinical psychology or counseling psychology, plus additional training in legal issues.

Some psychiatric nurses (nurses with additional training in psychiatry) provide similar services.

Counseling psychologists *help people with educational, vocational, marriage, health-related, and other decisions.* A counseling psychologist has a doctorate degree (PhD, PsyD, or EdD) with supervised experience in counseling. Whereas a clinical psychologist deals mainly with anxiety, depression, and other emotional distress, a counseling psychologist deals mostly with life decisions and family or career readjustments. Counseling psychologists work in educational institutions, mental health centers, rehabilitation agencies, businesses, and private practice.

You may also have heard of **forensic psychologists,** *who provide advice and consultation to police, lawyers, and courts.* Forensic psychologists are clinical or counseling psychologists who have additional training in legal issues. They advise on such decisions as whether a defendant is mentally competent to stand trial or whether someone eligible for parole is dangerous (Otto & Heilbrun, 2002). Several popular films and television series have depicted forensic psychologists helping police investigators develop a psychological profile of a serial killer. That may sound like an exciting, glamorous profession, but few psychologists engage in such activities (and the accuracy of their profiles is uncertain, as discussed in Chapter 14). Most criminal profilers today have training and experience in law enforcement, not psychology.

■ Table 1.1 compares various types of mental health professionals.

3. How does the education of a clinical psychologist differ from that of a psychiatrist?

Answer

3. A clinical psychologist earns an advanced degree in psychology, generally a PhD or PsyD, that focuses more on research. A psychiatrist earns an MD, like other medical doctors.

Service Providers to Organizations

Psychologists also work in business, industry, and school systems, doing work you might not recognize as psychology. The job prospects in these fields have been good, and you might find these fields interesting.

Industrial/Organizational Psychology

The psychological study of people at work is known as **industrial/organizational (I/O) psychology**. This field deals with such issues as hiring the right person for a job, training people for jobs, developing work teams, determining salaries and bonuses, providing feedback to workers about their performance, planning an organizational structure, and organizing the workplace so that workers will be productive and satisfied. I/O psychologists attend to both the individual workers and the organization, including the impact of economic conditions and government regulations.

Here's an example of a concern for industrial/organizational psychologists (Campion & Thayer, 1989): A company that manufactures complex electronic equipment needed to publish reference and repair manuals for its products. The engineers who designed the devices did not want to spend their time writing the manuals, and none of them were skilled writers anyway. So the company hired a technical writer to prepare the manuals. After a year, she received an unsatisfactory performance rating because the manuals she wrote contained too many technical errors. She countered that, when she asked various engineers in the company to check her manuals or to explain technical details to her, they were always too busy. She found her job complicated and frustrating. Her office was badly lit, noisy, and overheated, and her chair was uncomfortable. Whenever she mentioned these problems, she was told that she "complained too much."

In a situation such as this, an industrial/organizational psychologist helps the company evaluate its options. One solution would be to fire her and hire an expert on electrical engineering who is also an outstanding writer who tolerates a badly lit, noisy, overheated, uncomfortable office. However, if the company cannot find or afford such a person, then it needs to improve the working conditions and provide the current employee with more training and help.

Firefly Productions/CORBIS

Human factors specialists help redesign machines to make them easier and safer to use. This field uses principles of both engineering and psychology.

Human Factors

Learning to operate our increasingly complex machinery is one of the struggles of modern life. Sometimes, the consequences are serious. Imagine an airplane pilot who intends to lower the landing gear and instead raises the wing flaps. Or a worker in a nuclear power plant who fails to notice a warning signal. A type of psychologist known as a **human factors specialist** (or **ergonomist**) *attempts to facilitate the operation of machinery so that ordinary people can use it efficiently and safely.* Human factors specialists first worked in military settings, where complex technologies sometimes require soldiers to spot nearly invisible targets, understand speech through deafening noise, track objects in three dimensions, and make life-or-death decisions in a split second. The military turned to psychologists to redesign the tasks to fit the skills that their personnel could master.

Human factors specialists soon applied their expertise to the design of everyday devices, such as cameras, computers, microwave ovens, and cell phones. The field combines features of psychology, engineering, and computer science. It is a growing field with many jobs available.

Military Psychologists

Military psychologists are *specialists who provide services to the military* in many ways. Some are similar to industrial/organizational psychologists, conducting intellectual and personality tests to identify people suitable for certain jobs within the military, and then helping to train people for those jobs. Other military psychologists consult with the leadership about strategies, including the challenges of dealing with allies or enemies from a different culture. Still others provide clinical and counseling services to soldiers dealing with highly stressful experiences. Few experiences in life are more stressful than military combat.

Infants and young children will try to eat almost anything that tastes okay. As they grow older, they begin to avoid foods for reasons other than taste.

Also, some psychologists conduct research on such topics as how best to deal with battlefield stress, sleep deprivation, and other difficulties. Matthews (2014) has argued that military psychologists will become increasingly important, as future conflicts pertain more to influencing people than attacking them.

School Psychology

Many if not most children have school problems at one time or another. Some children have trouble sitting still or paying attention. Others get into trouble for misbehavior. Some have problems with reading or other academic skills. Others master their schoolwork quickly and become bored. They too need special attention.

School psychologists are *specialists in the psychological condition of students,* usually in kindergarten through the 12th grade. School psychologists identify children's educational needs, devise a plan to meet those needs, and then either implement the plan themselves or advise teachers how to implement it.

School psychology can be taught in a psychology department, a branch of an education department, or a department of educational psychology. In some countries, it is possible to practice school psychology with only a bachelor's degree. In the United States, the minimum education requirement for a school psychologist is usually a master's degree, but a doctorate may become necessary in the future. Most school psychologists work for a school system, but some work for mental health clinics, guidance centers, and other institutions.

Psychologists in Teaching and Research

Many psychologists, especially those who are not clinical psychologists, teach and conduct research in colleges and universities. To some extent, different kinds of psychologists study different topics. For example, developmental psychologists observe children, and biological psychologists examine the effects of brain damage. However, different kinds of psychologists also sometimes study the same questions, approaching them in different ways. To illustrate, let's consider one example: how we select what to eat. Different kinds of psychologists offer different explanations.

Developmental Psychology

Developmental psychologists *study how behavior changes with age,* "from womb to tomb." For example, they might examine language development from age 2 to 4 or memory from age 60 to 80, both describing the changes and trying to explain them.

With regard to food selection, some taste preferences are present from birth. Newborns prefer sweet tastes and avoid bitter and sour substances. However, they appear indifferent to salty tastes, as if they could not yet taste salts (Beauchamp, Cowart, Mennella, & Marsh, 1994). Toddlers will try to eat almost anything they can fit into their mouths, unless it tastes sour or bitter. For that reason, parents need to keep dangerous substances like furniture polish out of toddlers' reach. Older children become increasingly selective about the foods they accept, but up to age 7 or 8, usually the only reason children give for refusing something is that they think it would taste bad (Rozin, Fallon, & Augustoni-Ziskind, 1986). As they grow older, they cite more complex reasons for rejecting foods, such as health concerns.

Learning and Motivation

The research field of **learning and motivation** studies *how behavior depends on the outcomes of past behaviors and current motivations.* How often we engage in any particular behavior depends on the results of that behavior in the past.

We learn our food choices largely by learning what *not* to eat. For example, if you eat something and then feel sick, you form an aversion to the taste of that food, especially if it was unfamiliar. It doesn't matter whether you consciously think the food made you ill. If you eat something at an amusement park and then go on a wild ride and get sick, you may dislike that food, even though you know the ride was at fault.

Cognitive Psychology

Cognition means *thought and knowledge.* A **cognitive psychologist** *studies those processes.* (The root *cogn-* also shows up in the word *recognize,* which literally means "to know again.") Typically, cognitive psychologists focus on how people make decisions, solve problems, and convert their thoughts into language. These psychologists study both the best and the worst of human cognition (expert decision making and why people make costly errors).

Cognitive psychologists seldom study anything related to food selection, but cognitions about

food do enter into our food decisions. For example, people often refuse an edible food just because of the very idea of it (Rozin & Fallon, 1987; Rozin, Millman, & Nemeroff, 1986). Most people in the United States refuse to eat meat from dogs, cats, or horses. Vegetarians reject all meat, not because they think it would taste bad, but because they dislike the idea of eating animal parts. On average, the longer people have been vegetarians, the more firmly they regard meat eating as wrong (Rozin, Markwith, & Stoess, 1997).

How would you like to try the tasty morsels in ▶ Figure 1.3? You might be repulsed by the idea of eating insects, even if they are guaranteed to be safe and nutritious (Rozin & Fallon, 1987). Would you be willing to drink a glass of apple juice after you watched someone dip a cockroach into it? What if the cockroach was carefully sterilized? Some people not only refuse to drink that particular glass of apple juice but also say they have lost their taste for apple juice in general (Rozin et al., 1986). Would you drink pure water from a brand-new, never-used toilet bowl? Would you eat a piece of chocolate fudge shaped like dog feces? If not, you are guided by the idea of the food, not its taste or safety.

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▲ **Figure 1.3** Some cultures consider insects to be good food, whereas others consider them disgusting.

Biological Psychology

A **biopsychologist** (or **behavioral neuroscientist**) *explains behavior in terms of biological factors, such as activities of the nervous system, the effects of drugs and hormones, genetics, and evolutionary pressures.* How would a biological psychologist approach the question of how people (or animals) select foods?

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If you ate corn dogs and cotton candy and then got sick on a wild ride, something in your brain would blame the food, regardless of what you think consciously. This kind of learning helps us avoid harmful substances.

A small part of the difference among people in their taste preferences relates to the fact that some people have up to three times as many taste buds as others do, mostly for genetic reasons. The genes vary within each population, although the relative frequencies of strong tasters and weak tasters are fairly similar for Asia, Europe, and Africa (Wooding, Bamshad, Larsen, Jorde, & Drayna, 2004). People with the most taste buds usually have the least tolerance for strong tastes, including black coffee, black breads, hot peppers, grapefruit, radishes, and Brussels sprouts (Bartoshuk, Duffy, Lucchina, Prutkin, & Fast, 1998; Drewnowski, Henderson, Short, & Barratt-Fornell, 1998). Most of them also dislike foods that are too sweet (Yeomans, Tepper, Rietzschel, & Prescott, 2007).

Hormones also affect taste preferences. Many years ago, one child showed a strong craving for salt. As an infant, he licked the salt off crackers and bacon without eating the food itself. He put a thick layer of salt on everything he ate. Sometimes he swallowed salt directly from the shaker. When deprived of salt, he stopped eating and began to waste away. At the age of $3^1/_2$, he was taken to the hospital and fed the usual hospital fare. He soon died of salt deficiency (Wilkins & Richter, 1940).

The reason was that he had defective adrenal glands, which secrete the hormones that enable the body to retain salt (Verrey & Beron, 1996). He craved salt because he had to consume it fast enough to replace what he lost in his urine. (Too much salt is bad for your health, but too little salt is also dangerous.) Later research confirmed that salt-deficient animals immediately show an increased preference for salty tastes (Rozin & Kalat, 1971). Becoming salt deficient causes salty foods to taste especially good (Jacobs, Mark, & Scott, 1988). People often report salt cravings after losing salt by bleeding or sweating, and many women crave salt during menstruation or pregnancy.

Evolutionary Psychology

An **evolutionary psychologist** *tries to explain behavior in terms of the evolutionary history of the species, including why evolution might have favored a tendency to act in particular ways.* For example, *why* do people and other animals crave sweets and avoid bitter tastes? Here, the answer is easy: Most sweets are nutritious and almost all bitter substances are poisonous (T. R. Scott & Verhagen, 2000). Ancient animals that ate fruits and other sweets survived to become our ancestors.

However, although some evolutionary explanations of behavior are persuasive, others are debatable (de Waal, 2002). Yes, the brain is the product of evolution, just as any other organ is, but the question is whether evolution has micromanaged our behavior. The research challenge is to separate the

evolutionary influences on our behavior from what we have learned during a lifetime.

Social Psychology and Cross-Cultural Psychology

Social psychologists *study how an individual influences other people and how the group influences an individual.* For example, people usually eat together, and on the average we eat about twice as much when we are in a large group as we do when eating alone (de Castro, 2000). If you invite guests to your house, you offer them something to eat or drink as a way to strengthen a social relationship.

Cross-cultural psychology *compares the behavior of people from different cultures.* Comparing people from different cultures is central to determining what is truly characteristic of humans and what varies depending on our background.

Cuisine is one of the most stable and defining features of any culture. In one study, researchers interviewed Japanese high school and college students who had spent a year in another country as part of an exchange program. The students' satisfaction with their year abroad had little relationship to the educational system, religion, family life, recreation, or dating customs of the host country. The main determinant of their satisfaction was the food: Students who could sometimes eat Japanese food had a good time. Those who could not became homesick (Furukawa, 1997).

The similarity between the words *culture* and *agriculture* is no coincidence, as cultivating crops was a major step toward civilization. We learn from our culture what to eat and how to prepare it (Rozin, 1996). Consider, for example, cassava, a root vegetable that is poisonous unless someone washes and pounds it for three days. Can you imagine discovering that fact? Someone had to say, "So far, everyone who ate this plant died, but I bet that if I wash and pound it for three days, then it will be okay." That was a difficult and amazing discovery, but once someone discovered it, culture passed it on to later generations and eventually other countries and continents.

GC Stock/Alamy

Cassava, a root vegetable native to South America, is now a staple food in much of Africa as well. It grows in climates not suitable for most other crops. However, people must pound and wash it for days to remove the cyanide.

Table 1.2 summarizes some of the major fields of psychology, including several that have not been discussed.

4. a. Of the kinds of psychological research just described—developmental psychology, learning and motivation, cognitive psychology, biological psychology, evolutionary psychology, social psychology, and cross-cultural psychology—which field concentrates most on children?

b. Which two are most concerned with how people behave in groups?

c. Which concentrates most on thought and knowledge?

d. Which is most interested in the effects of brain damage?

e. Which is most concerned with studying the effect of a reward on future behavior?

5. Why do many menstruating women crave potato chips?

Answers

4. a. Developmental psychology. b. Social psychology and cross-cultural psychology. c. Cognitive psychology. d. Biological psychology. e. Learning and motivation.

5. By losing blood, they also lose salt, and a deficiency of salt triggers a craving for salty tastes.

Should You Major in Psychology?

If your main criterion for choosing a major is to get a high-paying job, your best bet is to major in engineering, computers, business, or one of the natural sciences (Rajecki & Borden, 2011). Nevertheless, psychology majors do get jobs, including many jobs with high interest or high opportunity for a sense of accomplishment. According to one survey, 20 to 25 percent of psychology majors took jobs such as personnel work or social services that relate closely to psychology (Borden & Rajecki, 2000). Others took a variety of jobs in business and government. Whatever the job, psychology courses prepare people to evaluate evidence, organize and write papers, handle statistics, listen carefully to what people say, and respect cultural differences. Those skills are important for almost anything you might do.

Many students major in psychology and then apply to medical school, dental school, law school, divinity school, or other professional schools. Find out what coursework is expected for the professional program of your choice and then

Table 1.2 Some Major Specializations in Psychology

Specialization	General Interest	Example of Interest or Research Topic
Biopsychologist	Relationship between brain and behavior	What body signals indicate hunger and satiety?
Clinical psychologist	Emotional difficulties	How can people be helped to overcome severe anxiety?
Cognitive psychologist	Memory, thinking	Do people have several kinds of memory?
Community psychologist	Organizations and social structures	Would improved job opportunities decrease psychological distress?
Counseling psychologist	Helping people make important decisions	Should this person consider changing careers?
Developmental psychologist	Changes in behavior over age	At what age can a child first distinguish between appearance and reality?
Educational psychologist	Improvement of learning in school	What is the best way to test a student's knowledge?
Environmental psychologist	How factors such as noise, heat, and crowding affect behavior	What building design can maximize the productivity of the people who use it?
Evolutionary psychologist	Evolutionary history of behavior	How did people evolve their facial expressions of emotion?
Human factors specialist	Communication between person and machine	How can an airplane cockpit be redesigned to increase safety?
Industrial/organizational psychologist	People at work	Should jobs be made simple and foolproof or interesting and challenging?
Learning and motivation specialist	Learning in humans and other species	What are the effects of reinforcement and punishment?
Personality psychologist	Personality differences	Why are certain people shy and others gregarious?
Psychometrician	Measuring intelligence, personality, interests	How fair are current IQ tests? Can we devise better tests?
School psychologist	Problems that affect schoolchildren	How should the school handle a child who regularly disrupts the classroom?
Social psychologist	Group behavior, social influences	What methods of persuasion are most effective for changing attitudes?

compare the coursework required for a psychology major. You will probably find that the psychology major is compatible with your professional preparation.

Suppose you want a career as a psychologist. The educational requirements vary among countries, but in the United States and Canada, nearly all jobs in psychology require education beyond a bachelor's degree. People with a master's degree can get jobs in mental health or educational counseling, but in most states, they must work under the supervision of someone with a doctorate. People with a PhD (doctor of philosophy) in clinical psychology or a PsyD (doctor of psychology) degree can provide mental health services. The main difference between the PhD and PsyD degrees is that the PhD includes an extensive research project, leading to a dissertation, whereas the PsyD degree does not. PsyD programs vary strikingly, including some that are academically strong and others with low standards (Norcross, Kohout, & Wicherski, 2005). A college teaching or research position almost always requires a PhD. An increasing percentage of doctorate-level psychologists now work in business, industry, and the military doing research related to practical problems.

For more information about majoring in psychology, prospects for graduate school, and a great variety of jobs for psychology graduates, visit the website of the American Psychological Association.

Types of Psychologists

Experimental psychology researchers, clinical psychologists, human factors specialists, and industrial/organizational psychologists are all psychologists, even though their daily activities have little in common. What unites psychologists is a dedication to progress through research.

This discussion of the various psychological approaches has been simplified in several ways. In particular, biological psychology, cognitive psychology, social psychology, and the other fields overlap significantly. Nearly all psychologists combine insights and information gained from several approaches. Many like to hyphenate their self-description to emphasize the overlap. For example, "I'm a social-developmental-cognitive neuroscientist."

As we proceed through this book, we shall consider one type of behavior at a time and, generally, one approach at a time. That is simply a necessity; we cannot talk intelligently about many topics at once. But bear in mind that all these processes do ultimately fit together. What you do at any given moment depends on a great many influences.

Summary

The page number after an item indicates where the topic is first discussed.

- *What is psychology?* Psychology is the systematic study of behavior and experience. Psychologists deal with both theoretical and practical questions. (page 3)
- *Three general themes.* Almost any behavior depends on many influences, and few statements apply to everyone all the time. Research progress depends on good measurement. Some conclusions in psychology are based on stronger evidence than others. (page 3)
- *Determinism–free will.* Determinism is the view that everything, including human behavior, has a physical cause. This view is difficult to reconcile with the feeling that humans have free will—that we deliberately, consciously decide what to do. (page 4)
- *Mind–brain.* The mind–brain problem is the question of how conscious experience relates to the activity of the brain. (page 5)
- *Nature–nurture.* Behavior depends on both nature (heredity) and nurture (environment). The relative contributions of nature and nurture vary from one behavior to another. (page 6)
- *Psychology and psychiatry.* Clinical psychologists have a PhD, PsyD, or master's degree. Psychiatrists are medical doctors. Both clinical psychologists and psychiatrists treat people with emotional problems, but psychiatrists can prescribe drugs and other medical treatments, whereas in most states, psychologists cannot. Counseling psychologists help people deal with difficult decisions, and less often deal with serious disorders. (page 6)
- *Service providers to organizations.* Nonclinical fields of application include industrial/organizational psychology, human factors, and school psychology. (page 8)
- *Research fields in psychology.* Psychology as an academic field has many subfields, including biological psychology, learning and motivation, cognitive psychology, developmental psychology, and social psychology. (page 9)
- *Job prospects.* People with a bachelor's degree in psychology enter a wide variety of careers or continue their education in professional schools. Those with an advanced degree in psychology have additional possibilities depending on their area of specialization. (page 11)

Key Terms

You can check the page listed for a complete description of a term. You can also check the glossary/index at the end of the text for a definition of a given term.

biopsychologist (or behavioral neuroscientist) (page 10)
clinical psychologist (page 6)
clinical social worker (page 7)
cognition (page 9)
cognitive psychologist (page 9)
counseling psychologist (page 7)
cross-cultural psychology (page 11)
determinism (page 4)
developmental psychologist (page 9)
dualism (page 5)
evolutionary psychologist (page 10)
forensic psychologist (page 7)
free will (page 4)
human factors specialist (or ergonomist) (page 8)
industrial/organizational (I/O) psychology (page 8)
learning and motivation (page 9)
mind–brain problem (page 5)
military psychologist (page 8)
monism (page 5)
nature–nurture issue (page 6)
psychiatry (page 6)
psychoanalyst (page 7)
psychology (page 3)
school psychologist (page 9)
social psychologist (page 11)

Review Questions

1. Which of the following ideas is essential to determinism?
   (a) People who try harder are more successful.
   (b) People choose their behaviors by free will.
   (c) Most differences in behavior are under genetic control.
   (d) Every behavior has a cause.
2. Which of the following contradicts the idea of dualism?
   (a) Biologists' principle of homeostasis
   (b) Physicists' principle of the conservation of matter and energy
   (c) Chemists' principle of ionic bonding
   (d) Psychologists' principle of reinforcement
3. Of the following, who can prescribe drugs?
   (a) Psychiatrists only
   (b) Clinical psychologists only
   (c) Psychoanalysts only
   (d) Psychiatrists, most psychoanalysts, and a few clinical psychologists
4. Here are four types of psychologists. Which one is correctly matched to a research area?
   (a) Social psychologist—evolution of behavior
   (b) Developmental psychologist—child behavior
   (c) Cognitive psychologist—how people behave in groups
   (d) Biological psychologist—thought and knowledge
5. Why do some people taste certain foods more strongly than others do?
   (a) The taste area of their brain is significantly larger.
   (b) They have up to three times as many taste buds.
   (c) They have higher amounts of a hormone produced by the adrenal gland.
   (d) They come from a culture that puts more value on taste.

Answers: 1d, 2b, 3d, 4b, 5b.

module 1.2

Psychology Then and Now

After studying this module, you should be able to:

- Describe the main research interests of the earliest psychologists.
- List some differences between psychology in its early days and psychology today.
- Explain why early psychologists rejected the study of conscious experience.

Imagine yourself as a young scholar in 1880. Enthusiastic about the new scientific approach in psychology, you decide to become a psychologist. Like other early psychologists, you have a background in either biology or philosophy. You are determined to apply the scientific methods of biology to the problems of philosophy.

So far, so good. But what questions will you address? A good research question is interesting and answerable. (If it cannot be both, it should at least be one or the other!) In 1880, how would you choose a research topic? You cannot get research ideas from a psychological journal because the first issue won't be published until the following year (in German). You cannot follow in the tradition of previous researchers because there haven't *been* any previous researchers. You are on your own.

In the next several pages, we shall explore some of the changes in what psychologists considered good research topics, including projects that dominated psychology for a while and then faded. We shall consider additional historical developments in later chapters. ▼ **Figure 1.4** outlines some major historical events inside and outside psychology.

The Early Era

The sciences of astronomy, physics, chemistry, and biology developed gradually over centuries. At first, all practitioners were amateurs. They worked in medicine, law, or other professions and did research in their spare time. Long before any people called themselves scientists, and long before universities began to include these fields as worthy areas of study, the amateur investigators had accumulated a great deal of knowledge.

In contrast, psychology began as a deliberate attempt to start a new science. In the late 1800s, several scholars noted the progress occurring in biology, chemistry, and other fields, and contrasted it to their perception that our understanding of mental processes had not advanced much since the time of Aristotle. They proposed to attack the age-old questions of mind by using the methods of science. Whether a science of mind was even possible, many doubted. But the only way to find out was to try.

Wilhelm Wundt and the First Psychological Laboratory

In 1879, medical doctor and sensory researcher Wilhelm Wundt (pronounced voont) set up in Leipzig, Germany, the first laboratory intended exclusively for psychological research. Wundt's interests were wide-ranging (Zehr, 2000), but one of his goals was to find the elements of experience, comparable to those of chemistry. Psychology's elements were, he maintained, sensations and feelings (Wundt, 1896/1902).[1] At any moment, you might experience the taste of a fine meal, the sound of good music, and a certain degree of pleasure. These elements would merge into a compound that was your experience. Furthermore, Wundt maintained, your experience is partly under your voluntary control; you can shift your attention from one element to another and get a different experience. To test his idea about the components of experience, Wundt presented various kinds of lights, textures, and sounds, and asked subjects to report the intensity and quality of their sensations. That is, he asked them to **introspect**—*to look within themselves.* He recorded the changes in people's reports as he changed the stimuli.

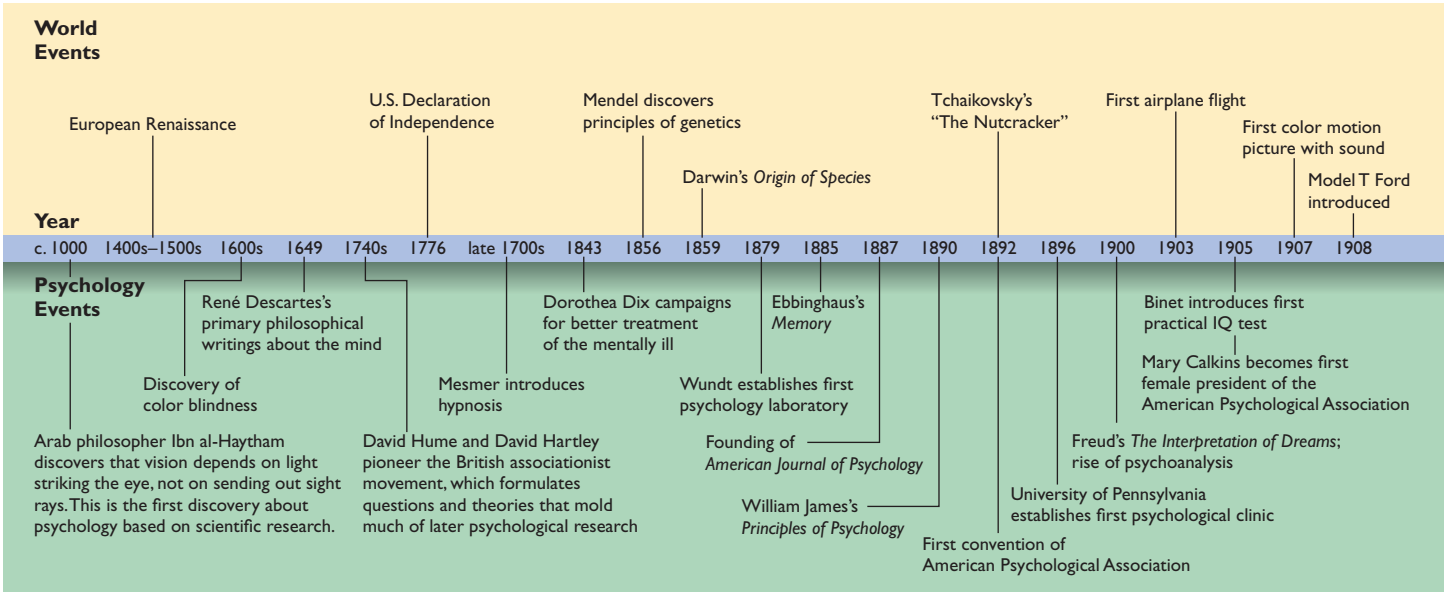
Wundt demonstrated the possibility of meaningful psychological research. For example, in one of his earliest studies, he set up a pendulum that struck metal balls and made a sound at two points on its swing. People would watch the pendulum and indicate where it appeared to be when they heard the sound. On average, people reported the pendulum to be about an eighth of a second in front of or behind the ball when they heard the strike (Wundt, 1862/1961). Apparently, the time we think we see or hear something is not the same as when the event occurs. Wundt's interpretation was that a person needs about an eighth of a second to shift attention from one stimulus to another.

Wundt and his students were prolific investigators, and the brief treatment here cannot do him justice. He wrote more than 50,000 pages about his research, but his main impact came from setting the precedent of collecting scientific data to answer psychological questions.

Edward Titchener and Structuralism

At first, most of the world's psychologists received their education from Wundt himself. One of his students, Edward Titchener, came to the United States in 1892 as a psychology professor at Cornell University. Like Wundt, Titchener believed that the main question of psychology was the nature of mental experiences.

[1]A reference citation containing a slash between the years, such as this one, refers to a book originally published in the first year (1896) and reprinted in the second year (1902).



▲ **Figure 1.4a-b** Dates of some important events in psychology and elsewhere. (Based partly on Dewsbury, 2000)

Titchener (1910) typically presented a stimulus and asked his subject to analyze it into its separate features—for example, to look at a lemon and describe its yellowness, brightness, shape, and other characteristics. He called his approach **structuralism,** *an attempt to describe the structures that compose the mind,* particularly sensations, feelings, and images. For example, imagine you are the psychologist: I look at a lemon and try to tell you my experience of its brightness separately from my experience of its yellowness.

Here is the problem. How do you know whether my reports are accurate? After Titchener died in 1927, psychologists soon abandoned both his questions and his methods. Why? Remember that a good scientific question is both interesting and answerable. Regardless of whether Titchener's questions about the elements of the mind were interesting, they seemed unanswerable.

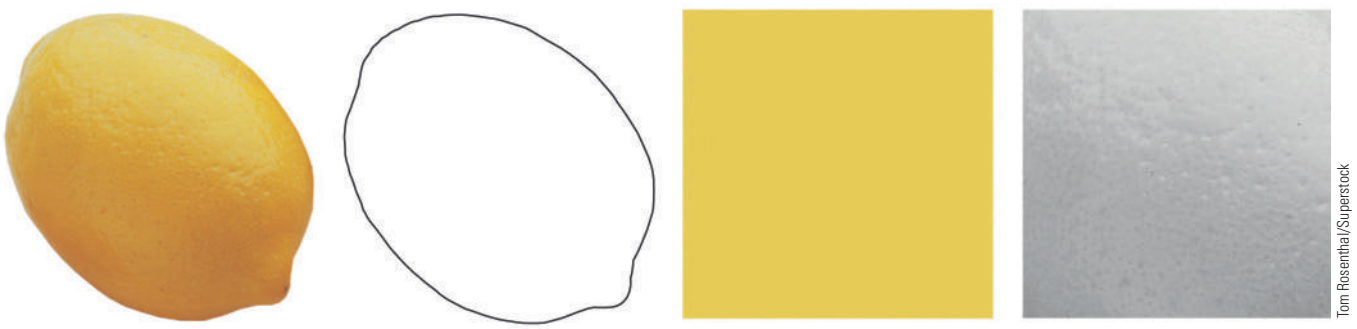
William James and Functionalism

In the same era as Wundt and Titchener, Harvard University's William James articulated some of the major issues of psychology and earned recognition as the founder of American psychology. James's book *The Principles of Psychology* (1890) defined many of the questions that still dominate psychology today.

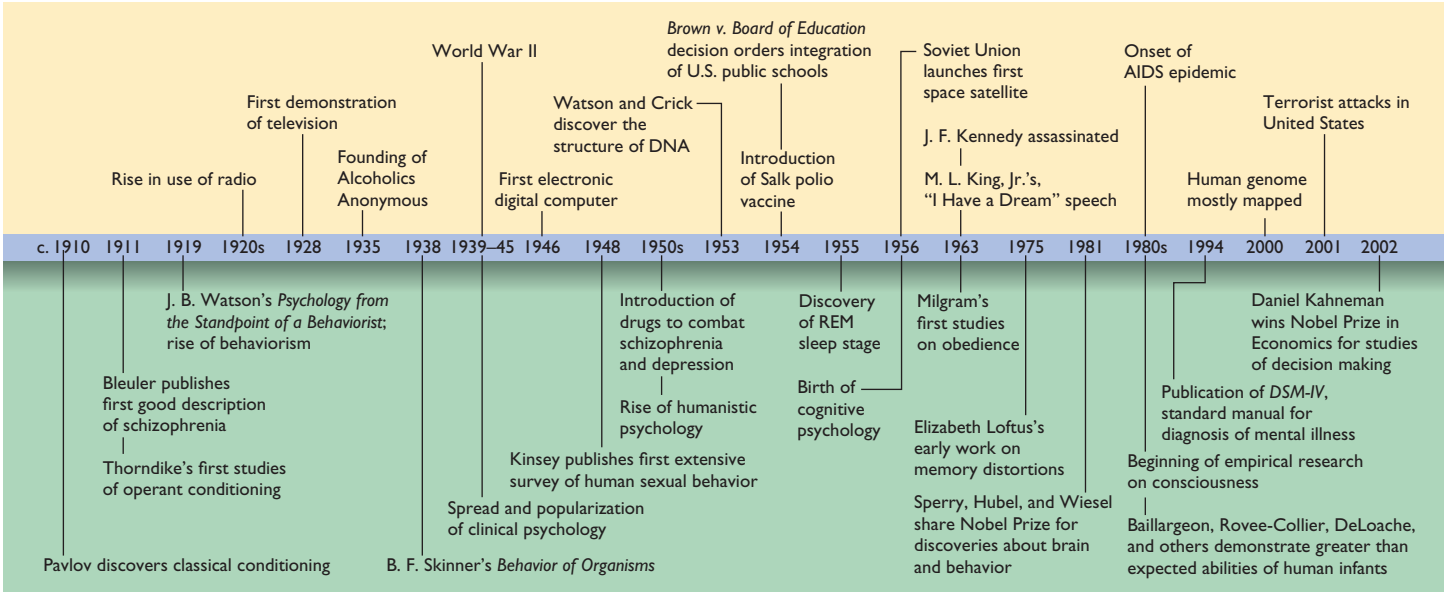
James had little patience with searching for the elements of the mind. He focused on what the mind *does* rather than what it *is.* That is, instead of seeking the elements of consciousness, he preferred *to learn how people produce useful behaviors.* For this reason, we call his approach **functionalism**. He suggested the following examples of good psychological questions (James, 1890):

- How can people strengthen good habits?
- Can someone attend to more than one item at a time?
- How do people recognize that they have seen something before?
- How does an intention lead to action?

James proposed possible answers but did little research of his own. His main contribution was to inspire later researchers to address the questions that he posed.



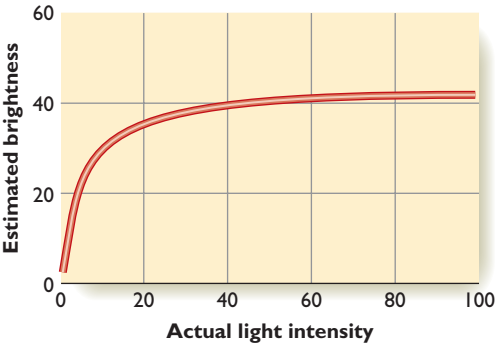
Edward Titchener asked subjects to describe their sensations. For example, they might describe their sensation of shape, their sensation of color, and their sensation of texture while looking at a lemon.

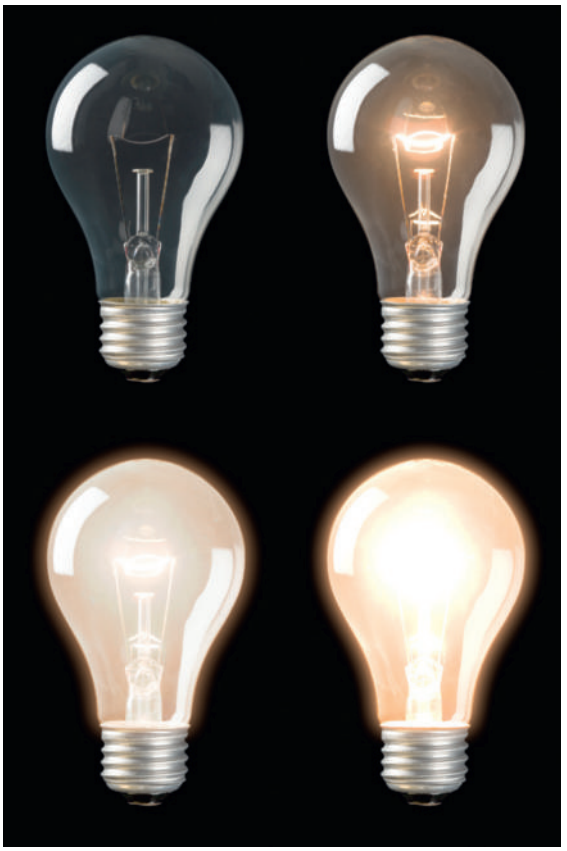


Studying Sensation

In the late 1800s and early 1900s, psychologists paid little attention to abnormal behavior, leaving it to psychiatrists. They devoted much of their research to the study of vision and other sensations. Why? One reason was that they wanted to understand mental experience, and experience consists of sensations. Another reason was that it makes sense to start with relatively easy, answerable questions. Sensation was certainly easier to study than, say, personality.

Early psychologists discovered major differences between physical stimuli and psychological perceptions. For example, a light that is twice as intense as another one does not look twice as bright. ▶ Figure 1.5 shows the relationship between the intensity of light and its perceived brightness. *The mathematical description of the relationship between the physical stimulus and its perceived properties* is called the **psychophysical function** because it relates psychology to physics. Such research demonstrated the feasibility of scientific research on psychological questions.





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▶ **Figure 1.5** This graph relates the perceived intensity of light to its physical intensity. When a light becomes twice as intense physically, it does not seem twice as bright. (Adapted from Stevens, 1961)

concept check

6. **What topic was the main focus of research for the earliest psychologists and why?**
7. **Why did psychologists abandon Titchener's structuralist approach?**

Answers

6. Early psychological research focused mainly on sensation because sensation is central to experience and because the early researchers believed that sensation questions were answerable.
7. Structuralists asked people to describe their inner experiences in detail. However, researchers had no way to check the accuracy of the reports.

Darwin and the Study of Animal Intelligence

Charles Darwin's theory of evolution by natural selection (Darwin, 1859, 1871) had an enormous impact on psychology as well as biology. Darwin argued that

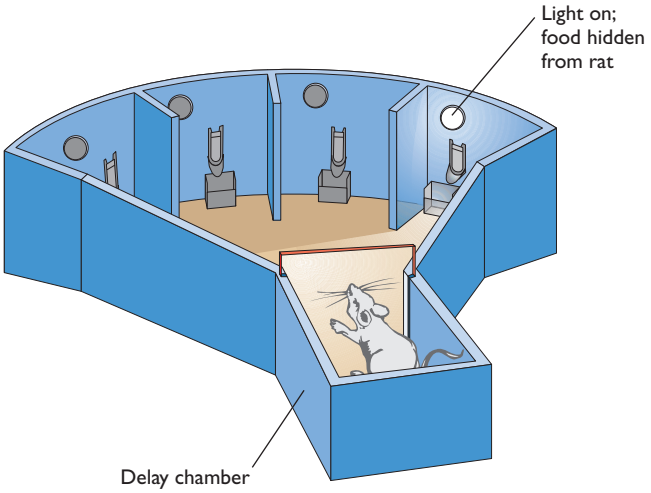
humans and other species share a remote common ancestor. If so, then other animals should share features in common with humans, including some degree of intelligence.

Based on this implication, early **comparative psychologists,** *specialists who compare different animal species,* did something that seemed more reasonable then than it does now: They set out to measure animal intelligence. They apparently imagined that they could rank-order animals from the smartest to the dullest. They set various species to such tasks as the delayed-response problem and the detour problem. In the *delayed-response problem,* an animal sees or hears a signal indicating where it can find food. After the signal, the animal is restrained for a delay to see how long the animal remembers the signal (see ▶ Figure 1.6). In the *detour problem,* an animal is separated from food by a barrier to see whether it takes a detour away from the food to reach it (▶ Figure 1.7).

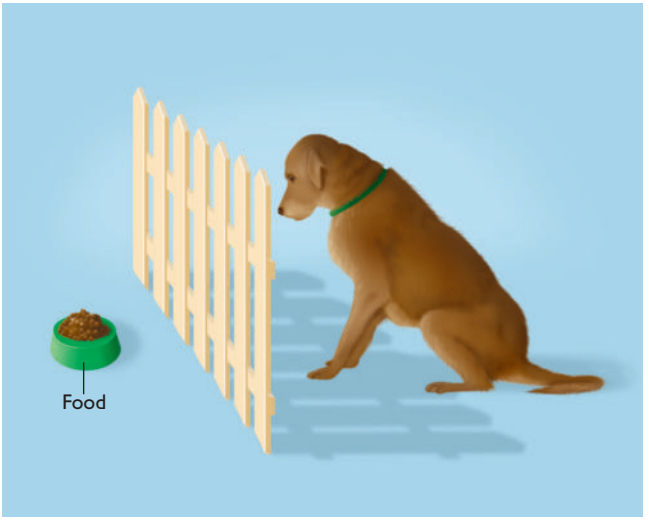
However, measuring animal intelligence turned out to be more difficult than it sounded. A species might seem dull-witted on one task but brilliant on another. For example, zebras are generally slow to learn to approach one pattern instead of another for food, unless the patterns happen to be narrow stripes versus wide stripes, in which case they excel (Giebel, 1958) (see ▶ Figure 1.8). Rats don't learn to find food hidden under the object that looks different from the others, but they easily learn to choose the object that *smells* different from the others (Langworthy & Jennings, 1972).

Eventually, psychologists decided that the relative intelligence of nonhuman animals was a pointless question. Different species excel in different ways, and it doesn't make sense to rank-order them.

Psychologists today continue to study animal learning, but the emphasis has changed. The questions are now, "What can we learn from animal studies about the mechanisms of intelligent behavior?" and "How did each species evolve the behavioral tendencies it shows?"



▲ **Figure 1.6** Early comparative psychologists assessed animal intelligence with the delayed-response problem. Variations on this task are still used today with humans as well as laboratory animals.



▲ **Figure 1.7** In the detour problem, an animal must go away from the food before it can move toward it.

Measuring Human Intelligence

While some psychologists studied animal intelligence, others examined human intelligence. Francis Galton, a cousin of Charles Darwin, was among the first to try to measure intelligence and to ask whether intellectual variations were based on heredity. Galton was fascinated with measurement (Hergenhahn, 1992). For example, he invented the weather map, measured degrees of boredom during lectures, suggested the use of fingerprints to identify individuals, and—in the name of science—attempted to measure the beauty of women in different countries.

In an effort to determine the role of heredity in human achievement, Galton (1869/1978) examined whether the sons of famous and accomplished men tended to become eminent themselves. (Women in 19th-century England had little opportunity for fame.) Galton found that the sons of judges, writers, politicians, and other noted men had a high probability of similar accomplishment themselves. He attributed this edge to heredity. (Do you think he had adequate evidence for his conclusion? If the sons of famous men become famous themselves, is heredity the only explanation?)

Galton tried to measure intelligence using simple sensory and motor tasks, but his measurements were unsatisfactory. In 1905, a French researcher named Alfred Binet devised the first useful intelligence test, which we shall discuss further in Chapter 9. At this point, just note that the idea of testing intelligence became popular in the United States and other Western countries. Psychologists,

▲ **Figure 1.8** Zebras learn rapidly when they have to compare stripe patterns (Giebel, 1958).

inspired by the popularity of intelligence tests, developed tests of personality, interests, and other psychological characteristics. Measuring human intelligence faces some of the same problems as animal intelligence: People have many intelligent abilities, and it is possible to be more adept at one than another. Much research goes into trying to make tests of intelligence fair and accurate.

The Rise of Behaviorism

Today it seems reasonable to define psychology as "the systematic study of behavior and experience." For a substantial period of psychology's history, most experimental psychologists would have objected to the words "and experience." Some psychologists still object today, though less strenuously. During the mid-1900s, most researchers described psychology as the study of behavior, period. They had little to say about minds, experiences, or anything of the sort. (According to one quip, psychologists had "lost their minds.")

What was the objection to studying experience? Recall the failure of Titchener's effort to analyze experience into its components. Most psychologists concluded that questions about mind were unanswerable. Instead, they focused on how changes in the environment alter behavior. They explored what learning is and how it occurs.

John B. Watson

Many regard John B. Watson as the founder of **behaviorism,** *a field of psychology that concentrates on observable, measurable behaviors and not on mental processes.* Watson was not the first behaviorist, but he systematized the approach and popularized it (Watson, 1919, 1925). Here are two quotes from Watson:

> Psychology as the behaviorist views it is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behavior. (1913, p. 158)
>
> The goal of psychological study is the ascertaining of such data and laws that, given the stimulus, psychology can predict what the response will be; or, on the other hand, given the response, it can specify the nature of the effective stimulus. (1919, p. 10)

Studies of Learning

Inspired by Watson, many researchers set out to study animal behavior, especially animal learning. One advantage of studying nonhuman animals is that the researcher can control the animals' diet, waking/sleeping schedule, and so forth far more completely than with humans. The other supposed advantage was that nonhuman learning might be simpler to understand. Many psychologists optimistically expected to discover simple, stimulus–response laws of behavior. Just as physicists could study gravity by dropping any object in any location, many psychologists in the mid-1900s thought they could learn all about behavior by studying rats in mazes. One highly influential psychologist, Clark Hull, wrote, "One of the most persistently baffling problems which confronts modern psychologists is the finding of an adequate explanation of the phenomena of maze learning" (1932, p. 25). Another wrote, "I believe that everything important in psychology (except perhaps . . . such matters as involve society and words) can be investigated in essence through the

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Early behaviorists studied rats in mazes. As they discovered that this behavior was more complicated than they supposed, their interest turned to other topics.

continued experimental and theoretical analysis of the determiners of rat behavior at a choice-point in a maze" (Tolman, 1938, p. 34).

As research progressed, psychologists found that the behavior of a rat in a maze was more complicated than they had expected. Just as psychologists of the 1920s abandoned the structuralist approach to the mind, later psychologists abandoned the hope that studying rats in mazes would quickly uncover universal principles of behavior. Psychologists continue to study animal learning, but the goals and methods have changed.

The behaviorist approach is still alive and well today, but it no longer dominates experimental psychology as it once did. The rise of computer science showed that it was possible to talk about memory, knowledge, and information processing in machines, and if machines can have such processes, presumably humans can, too. Psychologists demonstrated the possibilities of meaningful research on topics that behaviorists had avoided.

8. Why did behaviorists avoid the topics of thought and knowledge?

Answer 8. Behaviorists concentrate on observable behavior, whereas thought and knowledge are unobservable processes within an individual. The early behaviorists hoped to find simple stimulus–response laws of behavior.

From Freud to Modern Clinical Psychology

In the early 1900s, clinical psychology was a small field devoted largely to disorders of vision, hearing, movement, and memory (Routh, 2000). The treatment of mental illness remained the province of psychiatry. The Austrian psychiatrist Sigmund Freud revolutionized and popularized psychotherapy with his methods of analyzing patients' dreams and memories. He tried to trace current behavior to early childhood experiences, including children's sexual fantasies. We shall examine Freud's theories in Chapter 14. Freud was a persuasive speaker and writer, and his influence was enormous. By the mid-1900s, most psychiatrists in the United States and Europe were following his methods. However, Freud's influence in psychology has faded substantially since then.

During World War II, many soldiers wanted help in dealing with the traumas caused by their war experiences. Because psychiatrists could not keep up with the need, psychologists began providing therapy, and clinical psychology as we now know it began to develop. Instead of accepting theories based on the authority of Freud or anyone else, psychologists conducted research to evaluate forms of therapy and developed new, more effective methods.

9. What event led to the rise of clinical psychology as we know it today?

Answer 9. During and after World War II, the need for services was greater than psychiatrists could provide. Clinical psychologists began providing treatment for psychological distress.

Recent Trends

In its early days, psychology was an ambitious field, expecting to find a grand theory that would revolutionize our understanding and apply widely to all aspects of experience. A review of psychology's early history (Borch-Jacobsen & Shamdasani, 2012) quoted one psychologist who spoke of "a great chance for some future psychologue to make a name greater than Newton's," another one who anticipated that a great psychologist's name will "join those of Copernicus and Darwin," and another who said that "the present psychological situation calls out for a new Darwin of the mind." Sigmund Freud immodestly nominated himself: "Humanity has in the course of time had to endure from the hands of science two great outrages upon its naïve self-love. The first was when it realized that our earth was not the centre of the universe. . . . The second was when biological research robbed man of his peculiar privilege of having been specially created, and relegated him to a descent from the animal world. . . . But man's craving for grandiosity is now suffering the third and most bitter blow from present-day psychological research which is endeavouring to prove to the 'ego' of each one of us that he is not even master in his own house, but that he must remain content with the veriest scraps of information about what is going on unconsciously in his own mind" (Freud, 1915/1935, p. 252). Later, the behaviorists had their own high ambition: to discover simple laws of learning, analogous to the laws of physics. They hoped to state those laws with mathematical precision and apply them generally to explain and predict virtually all of behavior.

Most of today's psychologists are less confident that a grand theory of behavior will ever emerge, or that anyone will qualify as the Copernicus or Darwin of psychology. Most psychologists today attempt to answer more limited questions. **Basic research** seeks theoretical knowledge for its own sake, such as understanding the processes of learning and memory. **Applied research** deals with practical problems, such as how to help children with learning disabilities. The two kinds of research are mutually supportive. Understanding the basic processes helps applied researchers develop effective interventions. Those working toward practical solutions sometimes discover principles that are theoretically important.

Recall that some of the earliest psychological researchers wanted to study the conscious mind but became discouraged with Titchener's introspective methods. Since the 1960s, cognitive psychology (the study of thought and knowledge) has gradually gained in prominence. Although cognitive psychologists sometimes ask people to describe their thoughts, more often they measure the accuracy and speed of responses under various circumstances to draw inferences about the underlying processes.

For many years, the behaviorists who opposed any study of consciousness were right, as researchers had no way to do any meaningful research on the

topic. Beginning in the 1980s, several researchers found clever ways to identify the brain processes associated with consciousness.

Another rapidly growing field is neuroscience. New techniques of brain scanning now enable researchers to examine brain activity without opening the skull. Today, neuroscience influences nearly every aspect of psychology. Evolutionary psychology is another new emphasis. Animals that behaved in certain ways survived, reproduced, and became our ancestors. Those whose behaviors did not lead to reproductive success failed to pass on their genes. In some cases, we can cautiously infer the selective pressures that led to our current behaviors.

For many decades, researchers interested in personality concentrated mostly on what can go wrong, such as fear, anger, and sadness. The relatively new field of **positive psychology** *studies the predispositions and experiences that make people happy, productive, and successful.*

New fields of application have also arisen. Health psychologists study how people's health is influenced by their behaviors, such as smoking, drinking, sexual activities, exercise, diet, and reactions to stress. They also try to help people change their behaviors to promote better health. Sports psychologists apply psychological principles to help athletes set goals, train, and concentrate their efforts.

Psychologists today have also broadened their scope to include more of human diversity. In its early days, around 1900, psychology was more open to women than most other academic disciplines were, but even so, the opportunities for women were limited (Milar, 2000). Mary Calkins, an early memory researcher, was regarded as Harvard's best psychology graduate student, but she was denied a PhD because of Harvard's tradition of granting degrees only to men (Scarborough & Furomoto, 1987). She did, however, serve as president of the American Psychological Association, as did Margaret Washburn, another important woman in the early days of psychology.

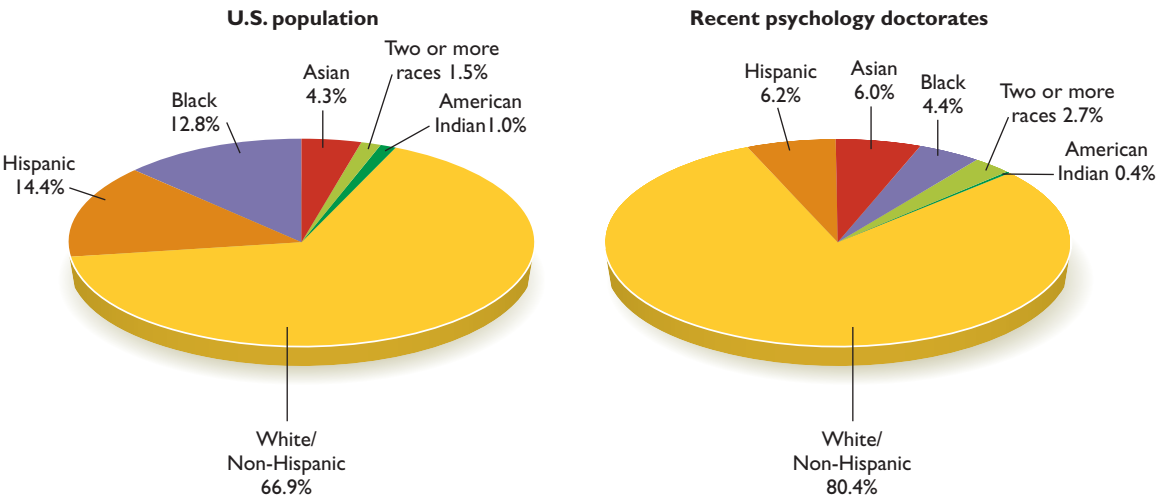
Today, women receive nearly three-fourths of the new PhDs in psychology and hold many leadership roles in psychological organizations. Minority students receive bachelor and master's degrees in psychology almost in proportion to their numbers in the total population. However, the number of African American and Hispanic students receiving PhD degrees lags behind the population norms, as shown in ▼ **Figure 1.9** (Center for Psychology Workforce Analysis and Research, 2007).

What will psychology be like in the future? A few likely trends are foreseeable. Because advances in medicine have enabled people to live longer, the psychology of aging is increasingly important. Because of depletion of natural resources and climate change, people will need to change their way of life in many ways that we cannot fully anticipate. Persuading people to change their behavior is a task for both politicians and psychologists.

10. In what way is psychology today less ambitious than it was in the early 1900s?

Answer

10. In the early 1900s, leading psychologists expected an insight that would revolutionize psychology in the same way that Darwin revolutionized biology. Fewer psychologists today expect such a grand theory.



◀ **Figure 1.9** Ethnic groups as a percentage of the U.S. population and as a percentage of people receiving doctorate degrees in psychology during 2005. (Source: Center for Psychology Workforce Analysis and Research, 2007)

Psychology through the Years

Throughout the early years of psychology, many psychologists devoted enormous efforts to projects that produced disappointing results, such as Titchener's search for the elements of the mind. Not all the efforts of early psychologists were fruitless, and in later chapters, you will encounter many classic studies that we still regard highly. Still, if some past psychologists spent their time on projects we now consider misguided, can we be sure that many of today's psychologists aren't on the wrong track?

We cannot, of course. Of all the theories and research projects that we now respect most dearly, some will stand the test of time and others will not. That is not a reason for despair. Much like a rat in a maze, researchers make progress by trial and error. They advance in a certain direction, and sometimes it leads to progress, and sometimes it leads to a dead end. But even exploring a dead end and eliminating it is progress, of a sort. Eventually, even when research doesn't lead to clear answers, at least it leads to better questions.

Summary

- *Choice of research questions.* During the history of psychology, researchers have several times changed their opinions about what constitutes an interesting, important, answerable question. (page 15)
- *First research.* In 1879, Wilhelm Wundt established the first laboratory devoted to psychological research. (page 15)
- *Limits of self-observation.* One of Wundt's students, Edward Titchener, attempted to analyze the elements of mental experience, relying on people's own observations. Other psychologists became discouraged with this approach. (page 15)
- *The founding of American psychology.* William James, the founder of American psychology, focused attention on how the mind guides useful behavior rather than on the contents of the mind. By doing so, he paved the way for the rise of behaviorism. (page 16)
- *Early sensory research.* In the late 1800s and early 1900s, many researchers concentrated on studies of the senses, partly because sensation is central to mental experience. (page 17)
- *Darwin's influence.* Charles Darwin's theory of evolution by natural selection influenced psychology in many ways. It prompted some prominent early psychologists to compare the intelligence of different species. That question turned out to be more complicated than expected. (page 17)
- *Intelligence testing.* The measurement of human intelligence was one concern of early psychologists that has persisted through the years. (page 18)
- *The era of behaviorist dominance.* As psychologists became discouraged with their attempts to analyze the mind, they turned to behaviorism. For many years, psychological researchers studied behavior, especially animal learning, to the virtual exclusion of mental experience. (page 19)
- *Maze learning.* During the mid-1900s, many experimental psychologists studied rats in mazes. As this approach failed to produce general laws of learning and behavior, researchers became discouraged with it and largely abandoned it. (page 19)
- *Freud.* Sigmund Freud's theories heavily influenced the early development of psychotherapy, although other methods are more widespread today. (page 20)
- *Clinical psychology.* At one time, psychiatrists provided nearly all the care for people with psychological disorders. After World War II, clinical psychology began to assume much of this role. (page 20)
- *Psychological research today.* Today, few psychologists expect a grand theory that will revolutionize our understanding in the same way that Darwin revolutionized biology. Today's psychologists study a wide variety of topics. Cognitive psychology has replaced behaviorist approaches to learning as the dominant field of experimental psychology. Neuroscience now influences researchers in almost all fields. Other new approaches are also becoming widespread. (page 20)

Key Terms

You can check the page listed for a complete description of a term.

applied research (page 20)
basic research (page 20)
behaviorism (page 19)
comparative psychologist (page 18)
functionalism (page 16)
introspect (page 15)
positive psychology (page 21)
psychophysical function (page 17)
structuralism (page 16)

Review Questions

1. Which of these topics was a major research concern for the earliest psychologists?
   (a) Vision and other sensations
   (b) Mental illness
   (c) Social conformity
   (d) Expert problem solving

2. In the early days of psychology, structuralists wanted to discover _____ and functionalists wanted to understand _____.
   (a) what mind can do . . . the elements that compose mind
   (b) the elements that compose mind . . . what mind can do
   (c) treatments for mental illness . . . the best ways to rear children
   (d) the best ways to rear children . . . treatments for mental illness

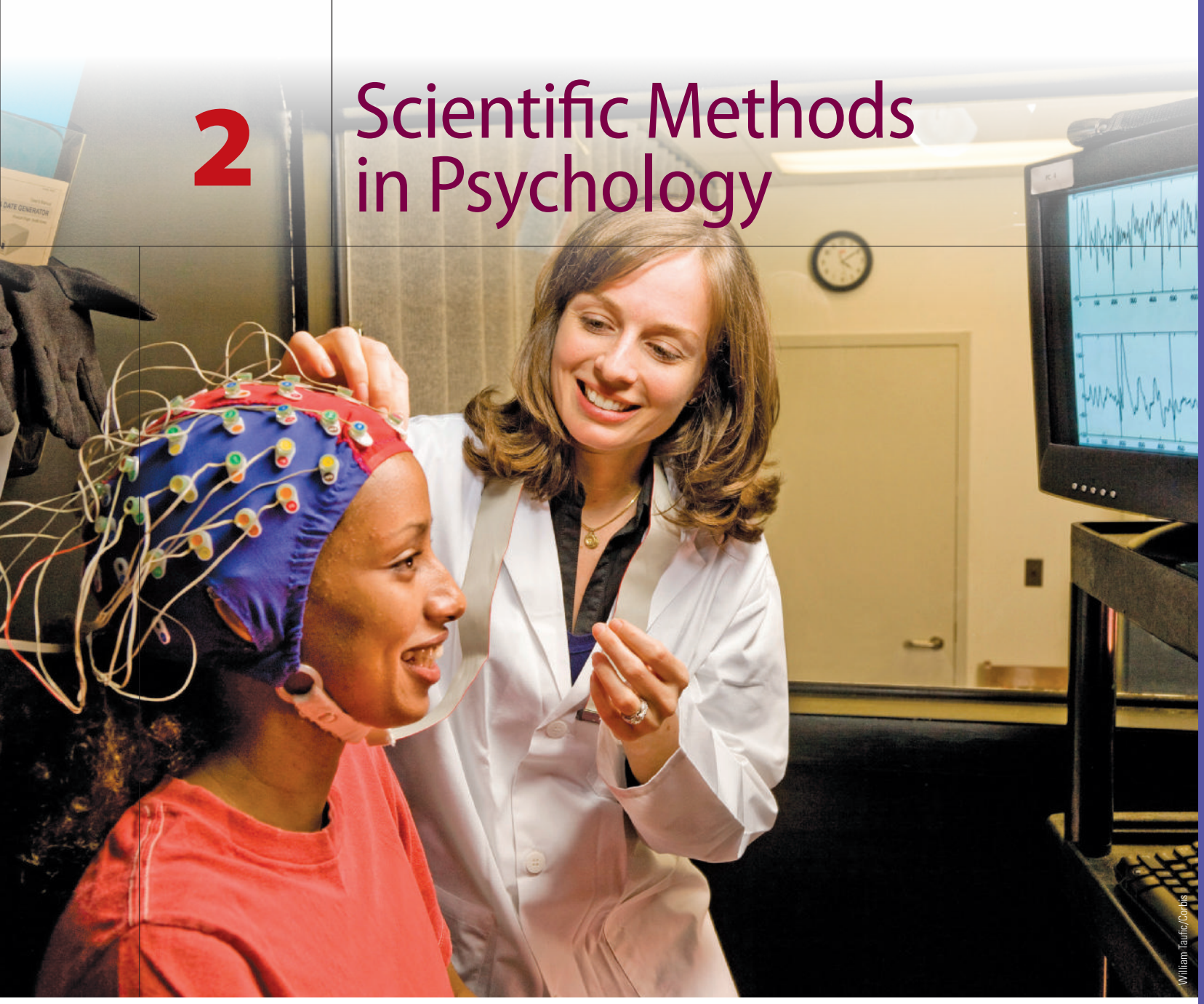
3. Which of these topics would a behaviorist probably avoid?
   (a) Stimulus–response connections
   (b) Animal behavior
   (c) Learning
   (d) Thought and knowledge

4. What event led to the rise of clinical psychology as we know it today?
   (a) World War II
   (b) Popular films that depicted mental illness
   (c) The writings of Sigmund Freud
   (d) Economic collapse

5. How does basic research differ from applied research?
   (a) Basic research is simpler, and requires less training.
   (b) Basic research is more complex, and requires greater training.
   (c) Basic research seeks solutions to current problems, rather than theoretical understanding.
   (d) Basic research seeks theoretical understanding, rather than a solution to a current problem.

Answers: 1a, 2b, 3d, 4a, 5d.

2 Scientific Methods in Psychology



Years ago, I was watching a Discovery Channel nature documentary about elephants. After the narrator discussed the enormous amount of food elephants eat, he started on their digestive system. He commented that the average elephant passes enough gas in a day to propel a car for 20 miles (32 km). I thought, "Wow, isn't that amazing!" and I told a couple of other people about it.

Later I started to think, "Wait a minute. *Who measured that?* Did someone attach a balloon to an elephant's rear end and collect gas for 24 hours? And then put it into a car and drive it? Was that a full-sized car or an economy car? City traffic or highway? How do they know they measured a typical elephant? Did they determine the mean for a broad sample of elephants?" My doubts quickly grew.

"Oh, well," you might say. "Who cares?" You're right; how far someone could propel a car on elephant gas doesn't matter. However, my point is not to ridicule the makers of this documentary but to ridicule *me*. Remember, I said I told two people about this claim before I started to doubt it. For decades, I had taught students to question assertions and evaluate the evidence, and here I was, uncritically accepting a silly statement and telling other people, who for all I know, may have gone on to tell other people. The point is that all of us yield to the temptation to accept unsupported claims, and we all need to discipline ourselves to question the evidence, especially evidence supporting claims that we would like to believe. This chapter concerns evaluating evidence in psychology.

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module 2.1

Evaluating Evidence and Thinking Critically

After studying this module, you should be able to:

- Discuss the importance of replicable results.
- Define burden of proof.
- Explain why scientists seek the most parsimonious explanation of any result.
- Explain why most psychologists are skeptical of claims of extrasensory perception.

What constitutes an explanation? Consider the following quote ("The Medals and the Damage Done," 2004, p. 604):

> In 2002, [Michael] Brennan was a British national rowing champion. . . . As the UK Olympic trials loomed, Brennan was feeling confident. But . . . for much of the past 12 months, Brennan's performance has been eroded by constant colds, aching joints and fatigue. . . . When the trials rolled round this April, Brennan . . . finished at the bottom of the heap. "I couldn't believe it," he says. To an experienced sports doctor, the explanation is obvious: Brennan has "unexplained underperformance syndrome" (UPS).

What do you think? Is "unexplained underperformance syndrome" an *explanation?*

Consider other examples: Birds fly south for the winter "because they have an instinct." Certain people get into fights "because they are aggressive." Certain students have trouble paying attention "because they have attention deficit disorder." Are these statements explanations? Or are they no better than unexplained underperformance syndrome? A good explanation goes beyond giving something a name, and finding good explanations requires good research.

Psychological Science

The word *science* derives from a Latin word meaning "knowledge." Psychologists insist that their field is a science, and they are often defensive about it, when faced with skepticism. To be fair, psychology differs from other scientific fields in many ways.

One way is its history. Other sciences began gradually from the work of amateurs. For centuries, people employed as physicians or other professions devoted some of their leisure time to recording the positions of the stars and planets, observing the result when they mixed chemicals, or watching animals. By the time anyone first thought of science as a job, and by the time universities first offered courses in sciences, the early scientists already had much to teach. Psychology, in contrast, began as a deliberate attempt to start a new science, applying the methods of the natural sciences to some of the questions of philosophy. The early psychology professors frankly didn't have much to teach, other than what biologists had already discovered about the sense organs.

Another issue is ethics. Chemists can do almost anything they want to a jar of chemicals, as long as they don't blow up the building. Psychologists dealing with people have stringent limits.

Gathering Evidence

Science is a search for knowledge based on carefully observed, replicable data. Let's first consider data collection, and then examine that word *replicable.*

Research starts with careful observation. A great deal of scientific research consists of observing and measuring. For example, Robert Provine (2000) studied laughter by visiting shopping malls and recording who laughed and when.

Good observations and measurements often suggest a pattern that leads to a **hypothesis**, which is *a clear predictive statement*, often an attempt to explain the observations. A test of a hypothesis goes through the series of steps described in the following four sections and illustrated in ▼ **Figure 2.1**. Articles in most scientific publications follow this sequence, too. In each of the remaining chapters of this book, you will find at least one example of a psychological study described in a section entitled "What's the Evidence?" Each of those will go through the sequence from hypothesis to interpretation.

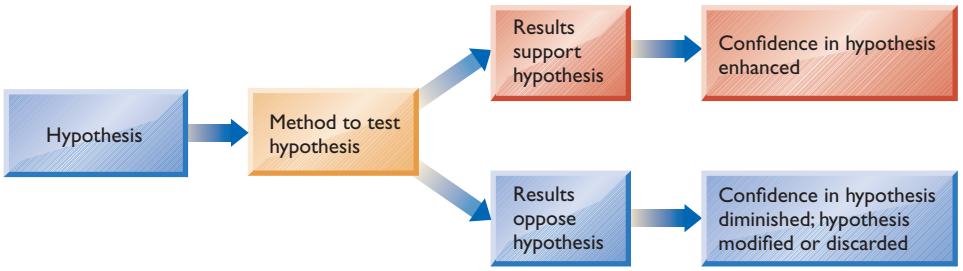
Hypothesis

A hypothesis can start with observations, such as noticing that some children who watch much televised violence are themselves aggressive. You might then form a hypothesis that watching violence leads to violence. A hypothesis can also be based on a more general statement, such as "children tend to imitate the behavior they see." A good hypothesis leads to predictions. For example, "if we let children watch violent television, they will behave more aggressively," or "if we decrease the amount of violence on television, the crime rate will decrease."

Method

Any hypothesis could be tested in many ways. One way to test the effects of televised violence would be to examine whether children who watch more violent programs are more violent themselves. When we find that on average they are, that result is only the start. It does not tell us about cause and effect: Does watching violence lead to violence? Or is it simply that people who are already violent like to watch violence?

A better method is to take a set of children, such as those attending a summer camp, randomly assign them to two groups and let one group watch violent programs while the other group watches nonviolent programs, and see whether the two groups differ in their violent behaviors (Parke, Berkowitz, Leyens, West, & Sebastian, 1977). The limitation is that researchers control what people watch for only a few days.



▶ **Figure 2.1** An experiment tests the predictions that follow from a hypothesis. Results either support the hypothesis or indicate a need to revise or abandon it.

Because any method has strengths and weaknesses, researchers vary their methods. If studies using different methods all point to the same conclusion, we gradually increase our confidence in the conclusion. A single study is almost never decisive (Greenwald, 2012).

Results

Fundamental to any research is measuring the outcome. A phenomenon such as "violent behavior" is tricky to measure. (Do threats count? Does verbal abuse? When does a push or shove cross the line between playfulness and violence?) It is important for an investigator to set clear rules about measurements. After making the measurements, the investigator determines whether the results are impressive enough to call for an explanation or whether the apparent trends might have been due to chance.

Interpretation

Researchers' final task is to consider what the results mean. If the results contradict the hypothesis, researchers should abandon or modify the original hypothesis. If the results match the prediction, investigators gain confidence in the hypothesis, but they also should consider other hypotheses that fit the results.

Replicability

Most scientific researchers are scrupulously honest in stating their methods and results. A major reason is that anyone who reports a scientific study must include the methods in enough detail for other people to repeat the procedure and, we hope, get similar results. Someone who reports results falsely runs a risk of being caught, and therefore distrusted from then on.

Replicable results are *those that anyone can obtain, at least approximately, by following the same procedures*. Scientists do make certain allowances for small effects. For example, one method of teaching might work better than another, but only slightly, so the advantage might not appear in all studies, especially those with a small number of participants. When researchers try to verify a small effect, they use a **meta-analysis**, *which combines the results of many studies as if they were all one huge study*. A meta-analysis also determines which variations in procedure increase or decrease the effects. However, if no one can find conditions under which the phenomenon occurs fairly consistently, we do not take it seriously. This rule may seem harsh, but it is our best defense against error.

Consider an example of a nonreplicable result. In the 1960s and early 1970s, several researchers trained rats to do something, chopped up the rats' brains, extracted certain chemicals, and injected those chemicals into untrained animals. The recipients then apparently remembered what the first group of rats had learned to do. From what we know of brain functioning, theoretically this procedure shouldn't work, but if it did, imagine the possibilities. Some people proposed, semiseriously, that someday you could get an injection of European history or introduction to calculus instead of going to class. Alas, the results were not replicable. When other researchers repeated the procedures, most of them found no effect from the brain extracts (L. T. Smith, 1975).

Psychological researchers have become increasingly concerned about the replicability of their findings. We shall consider the issue in more detail in the second module of this chapter.

1. How does a meta-analysis relate to replicability?

Answer

1. If some studies replicate an effect and others do not, a researcher may conduct a meta-analysis that combines all studies as if they were one large study.

Evaluating Scientific Theories

If replicable data support some hypothesis, eventually researchers propose a theory. A scientific **theory** is more than a guess. It is *an explanation or model that fits many observations and makes accurate predictions.* A good theory starts with as few assumptions as possible and leads to many correct predictions. In that way, it reduces the amount of information we must remember. The periodic table in chemistry is an excellent example: From the information about the elements, we can predict the properties of an enormous number of compounds.

One important reason for scientific progress is that scientists generally agree on how to evaluate theories. Whereas most people can hardly imagine evidence that would change their religious or political views, scientists can generally imagine evidence that would make them abandon their favorite theories in favor of other ones. (Oh, not always, of course. Some people can be stubborn.)

Burden of Proof

The philosopher Karl Popper emphasized scientists' willingness to disconfirm their theories by saying that the purpose of research is to find which theories are *incorrect.* That is, the point of research is to *falsify* the incorrect theories, and a good theory is one that withstands all attempts to falsify it. It wins by a process of elimination.

A well-formed theory is **falsifiable**—that is, *stated in such clear, precise terms that we can see what evidence would count against it*—if, of course, such evidence existed. For example, the theory of gravity makes precise predictions about falling objects. Because people have tested these predictions many times, and none of the observations have disconfirmed the predictions, we have high confidence in the theory.

This point is worth restating because "falsifiable" sounds like a bad thing. Falsifiable does not mean we actually have evidence against a theory. (If we did, it would be falsi*fied.*) Falsifiable means we can *imagine* something that would count as evidence against the theory. A theory that makes no definite prediction is not falsifiable. For example, many physicists believe that ours is just one among a huge number, perhaps an infinite number, of other universes. Can you imagine any evidence *against* that view? If not, it doesn't qualify as a good theory (Steinhardt, 2014). For a psychology example, Sigmund Freud claimed that all dreams are motivated by wish fulfillment. If you have a happy dream, it appears to be a wish fulfillment. However, if you have an unhappy dream, then Freud claimed that a censor in your brain disguised the wish. As Domhoff (2003) noted, Freud stated his theory in such a way that any observation counted for it or at least not against it (see ▶ **Figure 2.2**). If no possible observation could falsify the theory, it is too vague to be useful.

However, when Popper wrote that research is *always* an attempt to falsify a theory, he went too far. "All objects fall" (the law of gravity) is falsifiable. "Some objects fall" is not falsifiable, although it is certainly true—a pitifully weak statement, but nevertheless true. If "some objects fall" *were* false, you could not *demonstrate* it to be false!

Instead of insisting that all research is an effort to falsify a theory, another approach is to discuss **burden of proof**, *the obligation to present evidence to support one's claim.* In a criminal trial, the burden of proof is on the prosecution. If the prosecution does not make a convincing case, the defendant goes free. The reason is that the prosecution should be able to find convincing evidence if someone is guilty, but in many cases innocent defendants could not possibly demonstrate their innocence.

Similarly in science, the burden of proof is on anyone who makes a claim that should be demonstrable, if it is true. For the claim "some objects fall," the burden of proof is on anyone who supports the claim. (It's easy to fulfill that burden of proof, of course.) For the claim "every object falls," we cannot expect anyone to demonstrate it to be true for every object, and so the burden of proof is on someone who doubts the claim. (We continue to believe the statement unless someone shows an exception.) For a claim such as "UFOs from outer space have visited Earth" or "some people have psychic powers to perceive things without any sensory information," the burden of proof is on anyone who supports these statements. If they are true, someone should be able to show clear evidence.

Parsimony

What do we do if several theories fit the known facts? Suppose you notice that a picture on your wall is hanging on an angle. You consider four explanations:

- The ground shook when a big truck drove by.
- A gust of wind moved the picture.
- One of your friends bumped it without telling you.
- A ghost moved it.

▲ **Figure 2.2** According to Freud, every dream is based on wish fulfillment. If a dream seems unhappy, it is because a censor in your head disguised the wish. Can you imagine any observation that would contradict this theory?

All four explanations fit the observation, but we don't consider them on an equal basis. When given a choice among explanations that seem to fit the facts, we prefer the one whose assumptions are fewer, simpler, or more consistent with other well-established theories. This is known as the principle of **parsimony** (literally "stinginess") or *Occam's razor* (after the philosopher William of Occam). The principle of parsimony is a conservative idea: We stick with ideas that work and try as hard as we can to avoid new assumptions (e.g., ghosts).

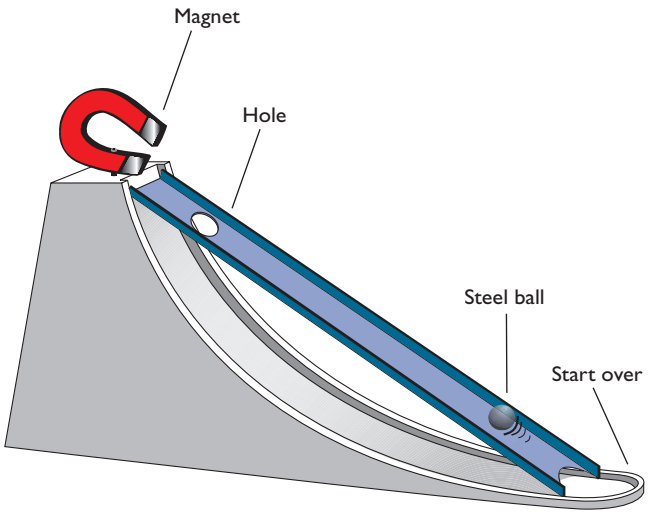
Parsimony and Degrees of Open-Mindedness

The principle of parsimony tells us to adhere to what we already believe, to resist radically new hypotheses. You might protest: "Shouldn't we remain open-minded to new possibilities?" Yes, if open-mindedness means a willingness to consider proper evidence, but not if it means the assumption that "anything has as much chance of being true as anything else." The stronger the reasons behind a current opinion, the more evidence you should need before replacing it.

For example, many people have attempted to build a "perpetual motion machine," one that generates more energy than it uses. (▼ **Figure 2.3** shows an example.) The U.S. Patent Office is officially closed-minded

on this issue, refusing even to consider patent applications for such machines. Physicists are convinced, both for logical reasons and because of consistent observations, that any work wastes energy, and that keeping a machine going always requires energy. If someone shows you what appears to be a perpetual motion machine, look for a hidden battery or other power source. If you don't find one, you can assume that you overlooked it. A claim as extraordinary as a perpetual motion machine requires extraordinary evidence.

Let's consider a couple of examples from psychology in which people have claimed very surprising results. Although it is fair to examine the evidence, it is also important to maintain a skeptical attitude and look as closely as possible for a simple, parsimonious explanation.



▲ **Figure 2.3** A proposed perpetual motion machine: The magnet pulls the metal ball up the inclined plane. When the ball reaches the top, it falls through the hole and returns to its starting point, from which the magnet will again pull the ball up. Can you see why this device is sure to fail? (See answer A on page 33.)

Applying Parsimony: Clever Hans, the Amazing Horse

Early in the 20th century, Wilhelm von Osten, a German mathematics teacher, set out to demonstrate the intellectual ability of his horse, Hans. To teach Hans arithmetic, he first showed him an object, said "one," and lifted Hans's foot. He raised Hans's foot twice for two objects and so on. With practice, Hans learned to look at a set of objects and tap the correct number of times. Soon it was no longer necessary for Hans to see the objects. Von Osten would just call out a number, and Hans would tap the appropriate number.

Mr. von Osten moved on to addition and then to subtraction, multiplication, and division. Hans caught on quickly, soon responding with 90 to 95 percent accuracy. Then von Osten and Hans began touring Germany, giving public demonstrations. Hans's abilities grew until he could add fractions, convert fractions to decimals or vice versa, do algebra, tell time to the minute, and give the values of German coins. Using a letter-to-number code, he could spell the names of objects and identify musical notes such as B-flat. (Evidently, he had perfect pitch.) He was usually correct even when questions were put to him by people other than von Osten, with von Osten out of sight.

Given this evidence, many people were ready to believe that Hans had great intellectual powers. But others sought a more parsimonious explanation. Oskar Pfungst (1911) observed that Hans could answer a question correctly only if the questioner knew the answer. Apparently, the questioner was giving away the answer. Also, Hans was accurate only when the questioner stood in plain sight.

Eventually, Pfungst observed that anyone who asked Hans a question would lean forward to watch Hans's foot. Hans had learned to start tapping whenever someone stood next to his forefoot and leaned forward. After Hans reached the correct number of taps, the questioner would give a slight upward jerk of the head and a change in facial expression, anticipating that this might be the last tap. (Even skeptical scientists who tested Hans did this involuntarily. After all, they thought, wouldn't it be exciting if Hans got it right?) Hans simply continued tapping until he saw that cue.

In short, Hans was indeed a clever horse, but we do not believe that he understood mathematics. Note that Pfungst did not demonstrate that Hans *didn't* understand mathematics. Pfungst merely demonstrated that he could explain Hans's behavior in the parsimonious terms of responses to facial expressions, and therefore, no one needed to assume anything more complex.

Applying Parsimony: Extrasensory Perception

The possibility of **extrasensory perception (ESP)** has long been controversial in psychology. Supporters of extrasensory perception claim that *some people*

Mary Evans Picture Library/The Image Works

Clever Hans and his owner, Mr. von Osten, demonstrated that the horse could answer complex mathematical questions with great accuracy. The question was, "How?" (After Pfungst, 1911, in Fernald, 1984.)

1. The great man will be struck down in the day by a thunderbolt. An evil deed, foretold by the bearer of a petition. According to the prediction another falls at night time. Conflict at Reims, London, and pestilence in Tuscany.
2. When the fish that travels over both land and sea is cast up on to the shore by a great wave, its shape foreign, smooth, and frightful. From the sea the enemies soon reach the walls.
3. The bird of prey flying to the left, before battle is joined with the French, he makes preparations. Some will regard him as good, others bad or uncertain. The weaker party will regard him as a good omen.
4. Shortly afterwards, not a very long interval, a great tumult will be raised by land and sea. The naval battles will be greater than ever. Fires, creatures which will make more tumult.

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◀ Figure 2.4 According to the followers of Nostradamus, each of these statements is a specific prophecy of a 20th-century event (Cheetham, 1973). What do you think the prophecies mean? Compare your answers to answer B on page 33.

sometimes acquire information without receiving any energy through any sense organ. Supporters claim that people with ESP can identify someone else's thoughts (telepathy) even from a great distance and despite barriers that would block any known form of energy. Supporters also claim that certain people can perceive objects that are hidden from sight (clairvoyance), predict the future (precognition), and influence such physical events as a roll of dice by mental concentration (psychokinesis).

Accepting any of these claims would require us not only to overhaul major concepts in psychology but also to discard the most fundamental tenets of physics. What evidence is there for ESP?

Anecdotes

Anecdotes are people's reports of isolated events, such as a dream or hunch that comes true. Such experiences often seem impressive, but they are not scientific evidence. Sooner or later, occasional bizarre coincidences are almost sure to occur, and people tend to remember them. At one point a company in North Carolina had two employees named Suresh C. Srivastava. What are the odds against that? Well, this is the wrong question. The odds against that particular coincidence may be high, but the chance of *some* strange coincidence occurring is highly likely, given a long enough wait.

Furthermore, we tend to remember, talk about, and sometimes exaggerate the hunches and dreams that do come true and forget the ones that don't. We could evaluate anecdotal evidence only if people recorded their hunches and dreams *before* the predicted events.

You may have heard of the "prophet Nostradamus," a 16th-century French writer who allegedly predicted many events of later centuries. ▲ Figure 2.4 presents four samples of his writings. All of his predictions are at this level of vagueness. After something happens, people imaginatively reinterpret his writings to fit the event. (If we don't know what a prediction means until *after* it occurs, is it really a prediction?)

Professional Psychics

Various stage performers claim to read other people's minds and perform other amazing feats. The Amazing Kreskin prefers to talk of his "extremely sensitive" rather than "extrasensory" perception (Kreskin, 1991). Still, part of his success as a performer comes from allowing people to believe he has uncanny mental powers.

After carefully observing Kreskin and others, David Marks and Richard Kammann (1980) concluded that they used the same kinds of deception commonly employed in magic acts. For example, Kreskin sometimes begins his act by asking the audience to read his mind. Let's try to duplicate this trick right now: Try to read my mind. I am thinking of a number between 1 and 50. Both digits are odd numbers, but they are not the same. For example, it could be 15 but it could not be 11. (These are the instructions Kreskin gives.) Have you chosen a number? Please do.

All right, my number was 37. Did you think of 37? If not, how about 35? You see, I started to think 35 and then changed my mind, so you might have got 35.

If you successfully "read my mind," are you impressed? Don't be. At first, it seemed that you had

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Magician Lance Burton can make people and animals seem to suddenly appear, disappear, float in the air, or do other things that we know are impossible. Even if we don't know how he accomplishes these feats, we take it for granted that they are based on methods of misleading the audience.