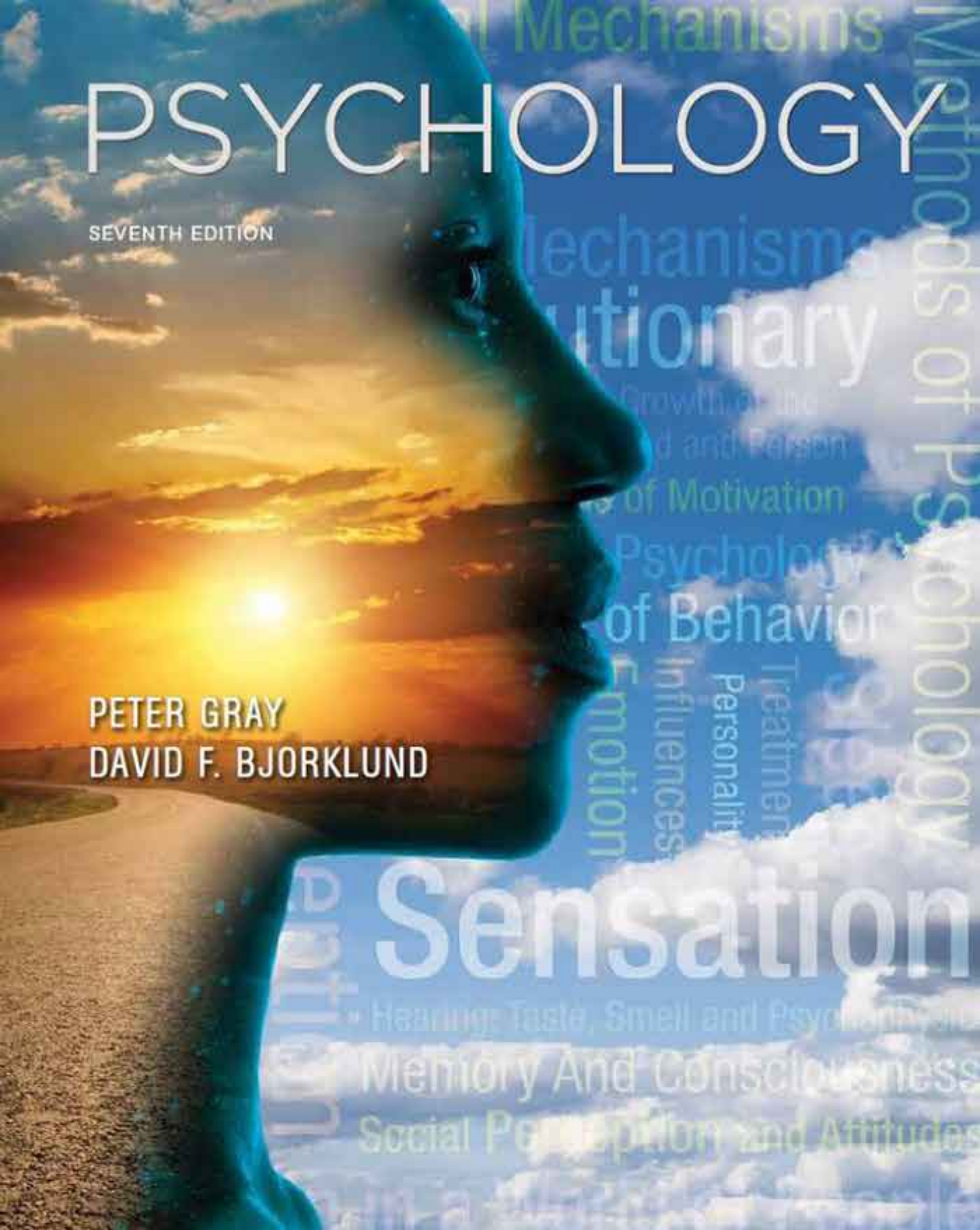
PSYCHOLOGY
SEVENTH EDITION
PETER GRAY
DAVID F. BJORKLUND
Mechanisms
Methods of Psychology
of Motivation
of Behavior
Emotion
Influences
Sensation
Memory And Consciousness

PSYCHOLOGY

PSYCHOLOGY

SEVENTH EDITION

PETER GRAY

Boston College

DAVID F. BJORKLUND

Florida Atlantic University

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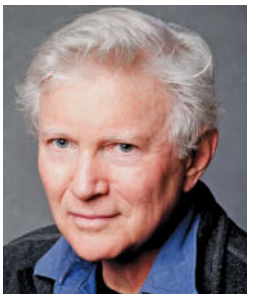

Kerry Burke

Peter Gray, Ph.D., was a full-time professor of psychology at Boston College for 30 years, where he served his department at various times as Department Chair, Undergraduate Program Director, and Graduate Program Director. He has published research in biological, evolutionary, cultural, developmental, and educational psychology; published articles on innovative teaching methods; taught more than 20 different undergraduate courses, including, most regularly, introductory psychology; helped develop a university-wide program to improve students' study and learning skills; and developed a program of research practicum courses. He is now retired from regular teaching but maintains a position as Research Professor at Boston College. Most of his current research and academic writing has to do with the value of play, especially free age-mixed play, in children's development. He is also author of *Free to Learn: Why Unleashing the Instinct to Play Will Make Our Children Happier, More Self-Reliant, and Better Students for Life* (Basic Books, 2013) and writes a popular blog for *Psychology Today* magazine entitled *Freedom to Learn: The Roles of Play and Curiosity as Foundations for Learning*.

Before joining Boston College, Peter Gray studied psychology as an undergraduate at Columbia University and earned a Ph.D. in biological sciences at the Rockefeller University. He earned his way through college by coaching basketball and working with youth groups in New York City. As a graduate student, he directed a summer biology program for talented high school students from impoverished neighborhoods. His avocations today include long distance bicycling, kayaking, backwoods skiing, and vegetable gardening.

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David F. Bjorklund, Ph.D., is a Professor of Psychology at Florida Atlantic University, where he has taught graduate and undergraduate courses in developmental and evolutionary psychology since 1976. He received a B.A. in psychology from the University of Massachusetts, an M.A. in psychology from the University of Dayton, and a Ph.D. in developmental psychology from the University of North Carolina at Chapel Hill. He has received numerous teaching and research awards from Florida Atlantic University and is the recipient of an Alexander von Humboldt Research Award.

David F. Bjorklund served as Associate Editor of *Child Development* (1997–2001) and is currently serving as Editor of the *Journal of Experimental Child Psychology*. He has served on the editorial boards of numerous journals and also served as a contributing editor to *Parents Magazine*. He has published more than 170 scholarly articles on various topics relating to child development and evolutionary psychology and has received financial support for his research from the National Science Foundation, the Spencer Foundation, and the German Research Foundation. David F. Bjorklund's other books include *Children's Thinking: Cognitive Development and Individual Differences*, now in its fifth edition (Cengage, 2012); *Why Youth is* Not *Wasted on the Young* (2007, Blackwell); *Child and Adolescent Development: An Integrative Approach* (with Carlos Hernández Blasi; 2012, Cengage); *Looking at Children: An Introduction to Child Development* (with Barbara Bjorklund; 1992, Brooks/Cole); *Parents Book of Discipline* (with Barbara Bjorklund; 1990, Ballantine); *Applied Child Study* (with Anthony Pellegrini; 1998, Erlbaum); *The Origins of Human Nature: Evolutionary Developmental Psychology* (with Anthony Pellegrini; 2002, American Psychological Association); *Children's Strategies: Contemporary Views of Cognitive Development* (1990, Erlbaum); *False-Memory Creation in Children and Adults: Theory, Research, and Implications* (2000, Erlbaum); and *Origins of the Social Mind: Evolutionary Psychology and Child Development* (edited with Bruce Ellis; 2005, Guilford). His current research interests include children's cognitive development and evolutionary developmental psychology. He lives in Jupiter, Florida, with his wife Barbara and enjoys traveling, cooking, playing basketball, and kayaking. He welcomes sincere feedback concerning this textbook from students as well as faculty, and can be reached by email at dbjorklu@fau.edu.

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An Introduction and Note from Peter Gray

The best and worst thing about authoring a psychology textbook is that it is a continuous work in progress. Psychology is such a dynamic field that whenever an author comes close to capturing it, it shape-morphs, sprints ahead, and laughs. For nearly three decades, this pursuit was my greatest academic challenge and pleasure. When I finally decided to drop this chase and devote more time to a new one, Worth Publishers pressed on to find a new author. In my conceit, I said, in effect, "You'll never find someone whose vision of psychology is close enough to mine and whose drive and ability for this pursuit is sufficient to maintain the book's spirit." But they didn't listen; and when they found David F. Bjorklund—a superb researcher, thinker, and writer whose work I already greatly admired—I was glad they hadn't listened. How flattering it was to know that he was interested in taking over this chase, and how grateful I am that he has continued it so beautifully.

David is no stranger to textbook writing. He has coauthored several child developmental psychology textbooks, and his *Children's Thinking* text is currently in its fifth edition. David is the perfect choice as a coauthor for this book. We met briefly at a professional meeting a few years ago; we had admired each other's research and writing and found we shared similar perspectives about psychology, how to teach it, and how to write about it.

Thank you, David; I can't imagine anyone more qualified than you for this pursuit. And thank you, Chris Cardone at Worth, for finding him.

Peter Gray

Preface

Long-Standing Goals for the Book

The primary purpose of a liberal arts education is to gain experience in thinking critically about ideas. Information today is available at everyone's fingertips; we don't need to store a lot of it in our heads. We do, however, need to use our heads to evaluate information and apply it logically to larger ideas. Our hope is that students who are introduced to psychology through our book will, upon hearing of some new idea in psychology, almost reflexively ask, "What is the evidence?" and will feel empowered to think logically and critically about that evidence.

Even if the goal of the book were merely to teach students the main concepts of psychology, the best means would still be one that stimulates thought. As cognitive psychologists have shown repeatedly, the human mind is not particularly good at absorbing and remembering miscellaneous pieces of information. It is designed for thinking, figuring out, and understanding; and it remembers what it understands. In the absence of some knowledge of the logic and evidence behind them, the concepts in psychology are words devoid of meaning.

In this book, critical thinking does not come in separate boxes or in exercises at the ends of chapters. It is—if we have done our job—woven through almost every paragraph of the text. We have entered each domain of psychology to identify its main questions, its main approaches to answering questions, its main discoveries, and the most durable ideas and theories that have resulted from those discoveries. In writing each edition of this book, we have constantly imagined ourselves carrying on a dialogue with an inquiring, thinking, appropriately skeptical student.

One of our dearest aims has been to achieve some small measure of the personal touch that William James accomplished so masterfully in *The Principles of Psychology*—the book that still stands, in our minds, as the best introduction to psychology ever written. While reading James, one constantly senses a mind at work, a mind that is honestly struggling to understand the big issues in psychology and that invites readers into the process. We also confess to sharing two of James's biases: rationalism and functionalism. As rationalists, we are uncomfortable presenting findings and facts without trying to make sense of them. Sometimes in our teaching of psychology we overplay the methods for gathering and analyzing data and underplay the value of logical thought. As functionalists, we want to know why, in terms of survival or other benefits, people behave as they do.

The functionalist theme runs through the book and is particularly emphasized in Part II (Chapters 3 and 4), *The Adaptiveness of Behavior*. Natural selection and learning are the two reasons behavior is functional, and we want students to know something about those processes, and their interaction, right from the start. The functionalist orientation also leads us, throughout the book, to pay more than the usual amount of attention to cross-cultural research and to behavioral processes as they operate in the contexts of people's everyday lives.

Goals for the Seventh Edition

Our two main goals in each revision of the book are (1) to keep the book current and accurate, and (2) to make the book more enjoyable and useful to all who read it.

Keeping the Book Current and Accurate

Most of the work and fun of each revision lies in our own continued learning and rethinking of each realm of psychology. In producing this revision, we skimmed thousands of new research articles and chapters and read hundreds carefully to determine which new developments warrant inclusion in the introductory course. The result was not so much the discovery of new ideas as the determination of how long-standing ideas are playing themselves out in current research and debate. This edition contains approximately 730 new references to research, mainly to works published within the past 5 years, out of a total reference list of approximately 2,750. On average, 28 percent of the references in each chapter are new. By including the most recent research and controversies, we can convey to students the understanding that psychology is a continuously advancing, dynamic, contemporary human activity, not a stale collection of facts.

When we compare this new edition of *Psychology* with the first edition, we see the great progress psychology has made in the past 20 years. What a pleasure it has been to keep pace with it! The progress has come on all fronts and is not easily summarized, but it is pleasing to us that the general theme of adaptation, which was central to Peter's initial conception of the book, is even more central to psychology today. Our basic behavioral machinery is adapted, by natural selection, to the general, long-standing conditions of human life. That machinery, however, is itself shaped, by natural selection, to be adaptive to the conditions of life within which the individual person develops. An enormous amount of research over the past few years, in all areas of psychology and neuroscience, elaborates on the theme of adaptation. That work is well represented in this new edition.

What's New in This Edition

Here are a few examples of new or expanded discussions in this edition that reflect our increased understanding of adaptive mechanisms:

- Chapter 3, *Genetics and Evolutionary Foundations of Behavior* introduces *epigenetics* and how it may play a role in both evolution and development.
- Chapter 4, *Basic Processes of Learning,* examines new evidence that, although children do not have an innate fear of snakes, they may be prepared to develop such a fear early in life. This chapter also includes a new discussion of applied behavior analysis.
- Chapter 5, *The Neural Control of Behavior,* presents the possible role of mirror neurons in social learning.
- Chapter 6, *Mechanisms of Motivation and Emotion,* discusses how "falling in love" is universal and may have been important for the pair bonding between men and women that is so crucial for rearing children.
- Chapter 7, *Smell, Taste, Pain, Hearing, and Psychophysics,* presents research showing how the sense of smell may play an important role in incest avoidance.
- Chapter 8, *The Psychology of Vision,* discusses research on the developmental plasticity of the visual system and the importance of multisensory integration.
- Chapter 9, *Memory and Attention*, and Chapter 11, *The Development of Body, Thought, and Language,* examine research on executive functions, their development, and their role in higher-order cognition.

- Chapter 10, *Solving Problems: Reasoning and Intelligence,* introduces the distinction between "fast" and "slow" thinking and the role each plays in human cognition.
- Chapter 12, *Social Development,* and Chapter 14, *Social Influences on Behavior,* present new evidence on children's and adults' prosocial behaviors and the dilemma of cooperation for social life.
- Chapter 13, *Social Perception and Attitudes,* discusses new research on self-control and free will.
- Chapter 15, *Personality,* introduces the concept of *differential susceptibility to environmental influence* and how it may help explain some the relations between early environment and later behavior.
- Chapter 16, *Mental Disorders,* presents the latest information concerning the DSM-5 and includes some of the causes and consequences of personality disorders as defined by the new DSM.
- Chapter 17, *Treatment,* expands on some of the new therapies used to treat mental disorders.

Making the Book More Enjoyable and Useful to All Who Use It

A book becomes more useful and enjoyable not by being "dumbed down" but by being "smartened up." The clearer the logic and the more precisely it is expressed, the easier a book is to understand and the more engaging it becomes. With each revision—and with feedback from adopters, students, and editors—we continually try new ways to make difficult ideas clearer without ignoring their inherent subtlety or complexity. In this edition, our efforts toward clarity were greatly facilitated by our development editor, Elsa Peterson. Elsa read the entire manuscript for the first time, as a student would, and helped very much to sharpen the wording and even suggested new research for us to consider.

In the last two editions, Peter made some major changes aimed at making the book more accessible to the full range of students. One such change was a reformulated Chapter 1, which became an orientation to the textbook and how to use its study features, as well as an orientation to psychology as a discipline. Another major change was the addition of a new review aid, *hierarchical review charts,* at the end of each major section within each chapter. The value of these charts is described in the "Special Features" section of this Preface and again, more fully, on pp. 3-27 of Chapter 1. Feedback from reviewers indicated that the new orientation chapter and the review charts have been very useful in helping students to learn from the book, and so these features have been retained and improved upon for this edition.

General Organization of the Book

The book is divided into eight parts, each of which consists of two or (in one case) three chapters.

Part I, *Background to the Study of Psychology,* has two relatively brief chapters. Chapter 1, *Foundations for the Study of Psychology,* is an orientation both to psychology as a discipline and to the book. It presents three major historical ideas that underlie contemporary psychology. It outlines the scope of contemporary psychology, and it offers students some advice about studying this book. Chapter 2, *Methods of Psychology,* lays out some general elements of psychological research that will be useful to students in later chapters. (This can be supplemented with the first three sections of the *Statistical Appendix,* found at the back of the book.)

Part II, *The Adaptiveness of Behavior,* is devoted explicitly to the functionalist theme that reappears throughout the book. Behavior can be understood as adaptation to the environment, which occurs at two levels—the phylogenetic level (through natural selection) and the individual level (through learning). Chapter 3, *Genetics and Evolutionary Foundations of Behavior,* includes the idea that even behaviors that are most highly prepared by evolution must develop, in the individual, through interaction with the environment. Chapter 4, *Basic Processes of Learning,* includes the idea that learning mechanisms themselves are products of evolution.

Part III, *Physiological Mechanisms of Behavior,* is concerned most directly with psychologists' attempts to explain behavior in terms of the neural and hormonal mechanisms that produce it. Chapter 5, *The Neural Control of Behavior,* is a functional introduction to the nervous system and to the actions of hormones and drugs. This chapter continues the theme of adaptation with an up-to-date discussion of neuroplasticity and brain mechanisms of learning. Chapter 6, *Mechanisms of Motivation and Emotion,* applies the preceding chapter's ideas about the nervous system and hormones to the topics of hunger, sex, reward mechanisms, sleep, and emotionality. The discussions of motives and emotions also pay ample attention to environmental influences.

Part IV, *Sensation and Perception,* is about the processes through which the brain or mind gathers information about the outside world. It contains Chapter 7, *Smell, Taste, Pain, Hearing, and Psychophysics,* and Chapter 8, *The Psychology of Vision*. The main question for both chapters is this: How does our nervous system respond to and make sense of the patterns of energy in the physical world? In both chapters the discussion of sensory and perceptual mechanisms is placed in a functionalist context. The senses are understood as survival mechanisms, which evolved not to provide full, objective accounts of the world's physical properties, but, rather, to provide the specific kinds of information that are needed to survive and reproduce.

Part V, *The Human Intellect,* is about the ability of the brain or mind to store information and use it to solve problems. Chapter 9, *Memory and Attention,* focuses on the roles of both unconscious and conscious mechanisms in attention, memory encoding, and memory retrieval, as well as how information is represented in memory. The chapter includes an analysis of the multiple memory systems that have evolved to serve different adaptive functions. Chapter 10, *Solving Problems: Reasoning and Intelligence*, deals with the cognitive processes by which people solve problems, both in everyday life and on structured tests, and with the measurement of intelligence and controversies associated with such measurement. Throughout these chapters, the information-processing perspective is highlighted but is tempered by ecological discussions that draw attention to the functions of each mental process and the environmental contexts within which it operates.

In sum, Parts II, III, IV, and V are all concerned with basic psychological processes—processes of learning, motivation, emotion, sensation, perception, attention, memory, and problem solving—and each process is discussed in a manner that integrates ideas about its mechanisms with ideas about its adaptive functions. The remaining three parts are concerned with understanding the whole person and the person's relationships to the social environment.

Part VI, *Growth of the Mind and Person,* is about developmental psychology. Its two chapters develop the functionalist perspective further by emphasizing the interactions between evolved human tendencies and environmental experiences in shaping a person's behavior. Chapter 11, *The Development of Body, Thought, and Language,* is concerned with the traditional topics of physical, cognitive, and language development. Chapter 12, *Social Development,* is concerned with the changes in social relationships and life tasks that occur throughout the life span and with ways in which these relationships and tasks vary across cultures. Chapter 12 also sets the stage for the next pair of chapters.

Part VII, *The Person in a World of People,* is about social psychology. Chapter 13, *Social Perception and Attitudes,* is concerned with the mental processes involved in forming judgments of other people, perceiving and presenting the self in the social

environment, and forming and modifying attitudes. Chapter 14, *Social Influences on Behavior,* deals with compliance, obedience, conformity, cooperation, competition, group decision-making, conflict, and the social regulatory roles of emotions. A theme of this chapter is the contrast between normative and informational influences. This unit on social psychology is placed before the one on personality and mental disorders because the insights of social psychology—especially those pertaining to social cognition—contribute to modern personality theories and to ways of understanding and treating mental disorders.

Part VIII, *Personality and Disorders,* incorporates material from the new DSM-5 and consists of three chapters on topics that students tend to identify most strongly as "psychology" before they enter the course. Chapter 15, *Personality,* has sections on the nature and origins of traits, the adaptive value of individual differences, and the classic theories of personality. Chapter 16, *Mental Disorders,* begins by discussing the problems involved in categorizing and diagnosing disorders and then, through the discussion of specific disorders, emphasizes the idea of multiple causation and the theme that the symptoms characterizing disorders are different in degree, not in kind, from normal psychological experiences and processes. Chapter 17, *Treatment,* offers an opportunity to recapitulate many of the main ideas of earlier chapters—now in the context of their application to therapy. Ideas from Parts II, III, V, and VII reappear in the discussions of biological, behavioral, and cognitive therapies, and ideas from the personality chapter reappear in the discussions of psychodynamic and humanistic therapies.

Although this ordering of topics makes the most sense to us, each chapter is written so that it can be read as a separate entity, independent of others. Links are often made to material presented in another chapter, but most of these cross-references are spelled out in enough detail to be understood by students who have not read the other chapter. The only major exception falls in the physiological unit: Chapter 6, on motivation, sleep, and emotion, assumes that the student has learned some of the basic information presented in Chapter 5, on the nervous system. Specific suggestions for making deletions within each chapter can be found in the *Instructor's Resources*, which is available on Worth Publishers' website, at http://www.worthpublishers.com/Catalog/product/psychology-seventhedition-gray.

Pedagogical Features of the Book

The main pedagogical feature of this or any other textbook is, of course, the narrative itself, which should be clear, logical, and interesting. Everything else is secondary. We have attempted through every page of every chapter to produce as logical and clear a flow of ideas as we possibly can. We have avoided the kinds of boxes and inserts that are often found in introductory psychology texts, because such digressions distract from the flow of thought and add to the impression that psychology is a jumble of topics that don't fit together very well.

We want students to read and think about the ideas of this book, not attempt to memorize bits and pieces of isolated information. Toward that end we have refrained from the use of review lists of terms, presented out of context of the larger arguments, and have developed, instead, study aids that help students to focus their attention on the arguments and think about individual findings and terms in relation to those arguments.

Focus Questions

The most useful study aid in this book—in our judgment and that of many students who have provided feedback—are the *focus questions*, which appear in the margins throughout the text at an average frequency of about 1 question per

page. Each question is designed to direct students' attention to the main idea, argument, or evidence addressed in the adjacent paragraphs of text. In Chapter 1 (on pp. 3–27) we spell out more fully the rationale behind the focus questions and offer advice to students for using them to guide both their initial reading and their review of each main section of each chapter. We ask students to develop the habit of reading and thinking about each focus question as they come to it, before they read the paragraph or paragraphs of text that answer that question. Most students, once they get used to this method of study, find that it helps them greatly in focusing their attention, stimulating their thought, and increasing their understanding of what they are reading. We have even had students tell us that the focus questions are so helpful that they find themselves writing their own focus questions in the margins of their other textbooks. We urge instructors to reinforce the value of the focus questions by talking about ways of using them in an early lecture and perhaps also by modeling their use with a think-aloud exercise.

The focus questions also offer instructors a means to make selective assignments within any chapter. The questions are numbered so instructors can easily let students know, with a list of numbers, which questions will be fair game for exams. The multiple-choice questions in the *Test Bank* are keyed by number to the focus questions. When we teach the course, we tell students that tests will consist of multiple-choice and brief essay questions that are derived from the book's focus questions. This makes clear what students must do to prepare. If they can answer the focus questions, they will do well on the test.

Hierarchical Section Reviews

At the end of each major section of each chapter, we provide a *section review,* which depicts explicitly the hierarchical structure that relates the section's main idea to its subordinate ideas and to specific observations and concepts that are relevant to those ideas. The primary purpose of this feature is to help students to review each section before moving on to the next. Here they can see, in one organized picture, the structure of the argument that they have just read. Some students may also find these charts useful as previews. By looking ahead at the section review before reading each new section, students can get a coherent overview, which should help them to read with greater focus and thought.

In Chapter 1 (pp. 3–27), we advise students on how to use the section reviews, but, as with the focus questions, we urge instructors to encourage their use by offering their own advice and, perhaps, by demonstrating in an early lecture how to use them.

Reflections and Connections and Find Out More

Because the focus questions and section reviews make a traditional end-of-chapter review unnecessary, we end each chapter with a section called *Reflections and Connections* that expands on the broad themes of the chapter, points out relationships to ideas discussed in other chapters, and raises new ideas for students to consider as they reflect on the chapter. In many cases these thoughts are aimed at helping students to see connections between ideas from different sections of the chapter that were not tied together in any of the section reviews.

Reflections and Connections is followed by a brief section called *Find Out More,* which contains thumbnail reviews of several relevant and interesting books, websites, and content from various media that are sufficiently nontechnical to be read by first-year students. The kinds of students who continue in psychology or in related disciplines, who become the next crop of professors or professional psychologists, are the ones who take most advantage of this feature.

MCAT 2015 Guidelines

Beginning in 2015, the Medical College Admission Test, (MCAT) is devoting 25 percent of its questions to the "Psychological, Social, and Biological Foundations of Behavior." The exam will also recognize the importance the sociocultural and behavioral determinants of health. The exam's new psychology section covers the breadth of topics in this text. For a full pairing of content, see this book's website at http://www.worthpublishers.com/Catalog/product/psychology-seventhedition-gray.

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- **Intuitive interface and design.** Students can be in only two places—either viewing the home page with their assigned content, or working to complete their assignments. Students navigation options and expectations are clearly laid out in front of them at all times, ensuring they can never get lost in the system.

Presentation Resources

- **New! The Worth Video Anthology for Introductory Psychology** is a complete collection of our video clips from the ***Video Tool Kit,*** the ***Digital Media Archive,*** and the third edition of the ***Scientific American Frontiers Teaching Modules,*** as well as from the new ***Worth Introductory Psychology Videos*** co-produced with ***Scientific American*** and ***Nature*** (breakthrough collection of modular, tutorial videos on core psychology topics). Available on flash drive, the set is accompanied by its own Faculty Guide.
- **New! Interactive Presentation Slides for Introductory Psychology** is an extraordinary series of PowerPoint® lectures. This is a dynamic, yet easy-to-use, new way to engage students during classroom presentations of core psychology topics. This collection provides opportunities for discussion and interaction, and includes an unprecedented number of embedded video clips and animations.

Assessment and Other Instructor Resources

- **New! LearningCurve—**LearningCurve is an adaptive quizzing and personalized learning program that puts the concept of "testing to learn" into action. Based on research on how students learn, LearningCurve really works: Gamelike quizzing motivates students to engage with their course, and reporting tools help teachers get a handle on what their class needs to focus on.
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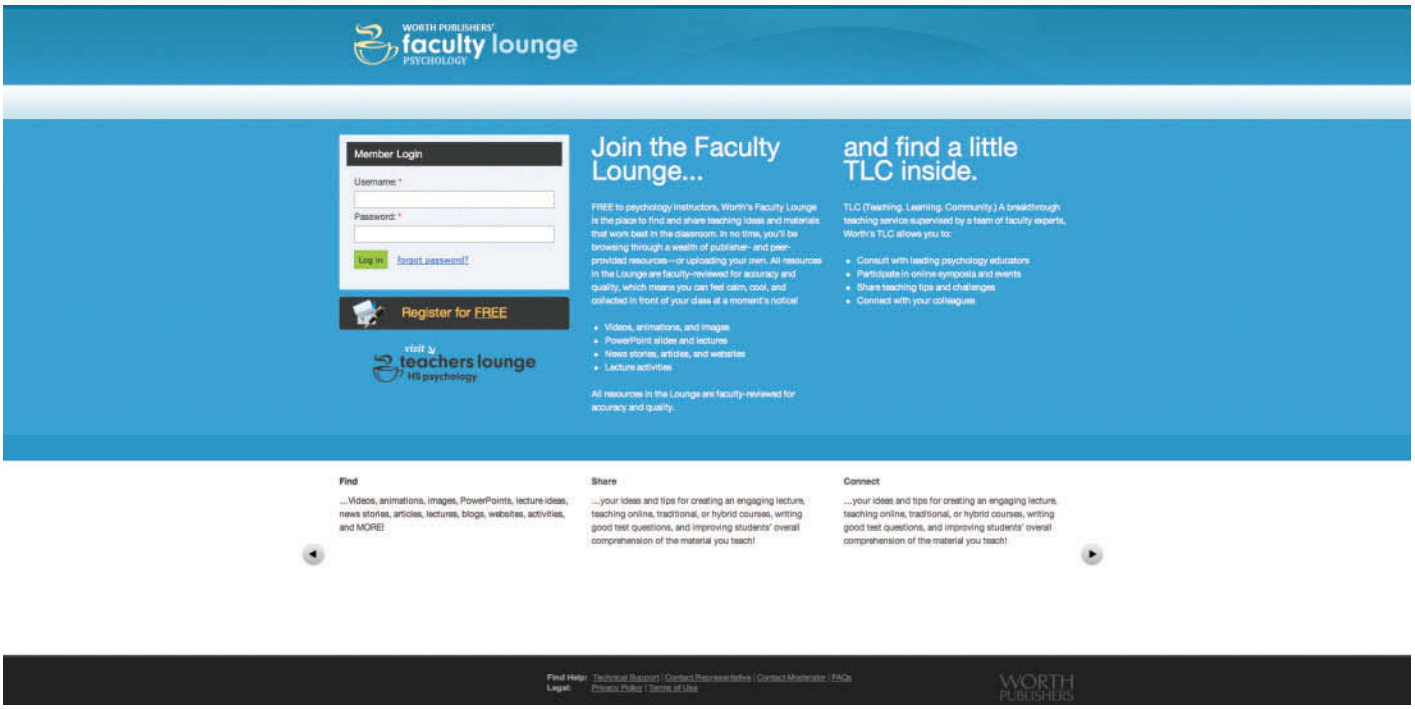

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PSYCHOLOGY

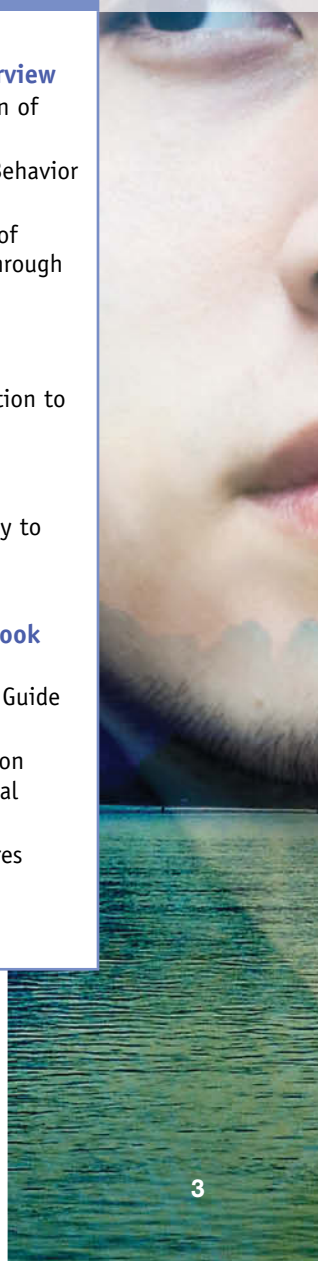
Background to the Study of Psychology

"Know thyself." These two words were inscribed on the shrine of the Oracle of Apollo, at Delphi, Greece, in the sixth century BCE. Throughout recorded history, people have striven to understand the nature of being human, to fathom the mysteries of the human mind and human behavior. Today that endeavor is pursued as a science, the science of psychology. In this first, background unit, we examine some ideas that helped to bring about a science of psychology, and we preview some of the methods that help to make psychology a science.

PART I

Foundations for the Study of Psychology

1



The human being, as far as any human being can tell, is the only creature that contemplates itself. We not only think, feel, dream, and act, but also wonder how and why we do these things. Such contemplation has taken many forms, ranging from just plain wondering to folk tales and popular songs, to poetry and literature, to formal theologies and philosophies. A little more than a century ago, human self-contemplation took a scientific turn, and we call that science psychology.

Welcome! Welcome to *Psychology* and to psychology—that is, to this book and to the field of study it is about. We hope you will enjoy them both. The principal questions of psychology are among the most fascinating that anyone can ask: Why do people feel, think, and behave the way they do? Are we the result of our genes, or of our experiences? How important are our goals versus our past in determining what we do? Is there a separation between mind and body? In this book you will read of many ways by which psychologists go about trying to answer such questions, and you will discover many dozens of findings and ideas that help to answer them.

It is useful to begin with a formal definition of our subject: ***Psychology*** is the *science* of *behavior* and the *mind*. In this definition, ***behavior*** refers to the observable actions of a person or an animal. ***Mind*** refers to an individual's sensations, perceptions, memories, thoughts, dreams, motives, emotions, and other subjective experiences. It also refers to all of the unconscious knowledge and operating rules that are built into or stored in the brain and that provide the foundation for organizing behavior and conscious experience. ***Science*** refers to all attempts to answer questions through the systematic collection and logical analysis of

CHAPTER OUTLINE

objectively observable data. Most of the data in psychology are based on observations of behavior because behavior is directly observable and the mind is not, but psychologists often use those data to make inferences about the mind.

Psychology is also an applied discipline—one of the "helping professions." Clinical psychologists and others who work in applied areas of psychology often help people cope with everyday problems. They may also see clients with more serious mental or behavioral problems such as phobias (unreasonable fears), excessive anxiety, obsessive-compulsive behavior and thought, or depression. We will talk more about the different disciplines within psychology toward the end of this chapter and will discuss mental disorders and their treatment in Chapters 16 and 17. It's worth noting here that most discussion in this book will deal with the science of typical behavior and thought: how most people think and behave most of the time and the factors that influence such actions. However, we will also examine individual differences in thought and behavior. In some cases, we will look at differences within the typical, or normal, range of functioning, such as some people being more outgoing than others, or sex differences in aggression or sensory abilities. In other cases, we will examine atypical thought and behavior, such as in autism, schizophrenia, or extreme reactions to stress like post-traumatic stress disorder (PTSD).

In this opening chapter, we do three things, all aimed at helping to prepare you for the rest of the book. First, we present you with a tiny bit of the history and philosophy that predate and underlie modern psychology. More specifically, we describe the historical origins of three ideas that are so basic to our science that we refer to them as "fundamental ideas for psychology." Second, we describe the scope of modern psychology, especially the various explanatory concepts, or levels of analysis, that psychologists use in their attempts to understand behavior and mind. Third, we describe the features of this book and how you might use them to maximize your enjoyment of it and your ability to learn from it. We put that section last because we thought you might learn more from it after you have read a bit of the book than you would if it came first. If you prefer to read that section first, please do. It starts on page 22.

1

How will you use the focus questions (such as this one) in the text's margins as a guide to reading this book?

There is one feature of the book that we want you to notice right now, however. In the margins of the text, throughout the book, you will find numbered focus questions. The first such question appears in the margin next to the paragraph you are reading right now. These are the questions that the text tries to answer, and they are also good self-test questions. An effective way to study this book is to read and think about each focus question as you come to it, before you read the adjacent paragraphs of text, which are aimed at answering that question. This method of study will help you focus your attention on the text and understand and remember what you read. If you read with the active intention of answering the focus questions, your attention is less likely to drift, and you are more likely to understand and think about what you read than if you read passively just to "learn" or "absorb" the material. In addition, after reading the whole chapter or a section of it, you might review by rereading each focus question and answering it in your own words.

Three Fundamental Ideas for Psychology: A Historical Overview

The founding of psychology as a formal, recognized, scientific discipline is commonly dated to 1879, when Wilhelm Wundt opened the first university-based psychology laboratory in Leipzig, Germany. At about that same time, Wundt also authored the first psychology textbook and began mentoring psychology's first official graduate students. The first people to earn Ph.D. degrees in psychology were Wundt's students.

But the roots of psychology predate Wundt. They were developed by people who called themselves philosophers, physicists, physiologists, and naturalists.

In this section, we examine three fundamental ideas of psychology, all of which were conceived of and debated before psychology was recognized as a scientific discipline. Briefly, the ideas are these:

1. Behavior and mental experiences have physical causes that can be studied scientifically.
2. The way people behave, think, and feel is modified over time by their experiences in their environment.
3. The body's machinery, which produces behavior and mental experiences, is a product of evolution by natural selection.

René Descartes Descartes' speculations in the seventeenth century about reflexes and the interaction of the body and soul in controlling voluntary actions were an important step toward a scientific analysis of human behavior.

The Idea of Physical Causation of Behavior

Before a science of psychology could emerge, people had to conceive of and accept the idea that questions about human behavior and the mind can, in principle, be answered scientifically. Seeds for this idea can be found in some writings of the ancient Greeks, who speculated about the senses, human intellect, and the physical basis of the mind in ways that seem remarkably modern. But these seeds lay dormant through the Middle Ages and did not begin to sprout again until the fifteenth century (the Renaissance) or to take firm hold until the eighteenth century (the Enlightenment).

Until the eighteenth century, philosophy was tightly bound to and constrained by religion. The church maintained that each human being consists of two distinct but intimately conjoined entities, a material body and an immaterial soul—a view referred to today as ***dualism.*** The body is part of the natural world and can be studied scientifically, just as inanimate matter can be studied. The soul, in contrast, is a supernatural entity that operates according to its own free will, not natural law, and therefore cannot be studied scientifically. This was the accepted religious doctrine, which—at least in most of Europe—could not be challenged publicly without risk of a charge of heresy and possible death. Yet the doctrine left some room for play, and one who played dangerously near the limits was the great French mathematician, physiologist, and philosopher René Descartes (1596–1650).

Descartes' Version of Dualism: Focus on the Body

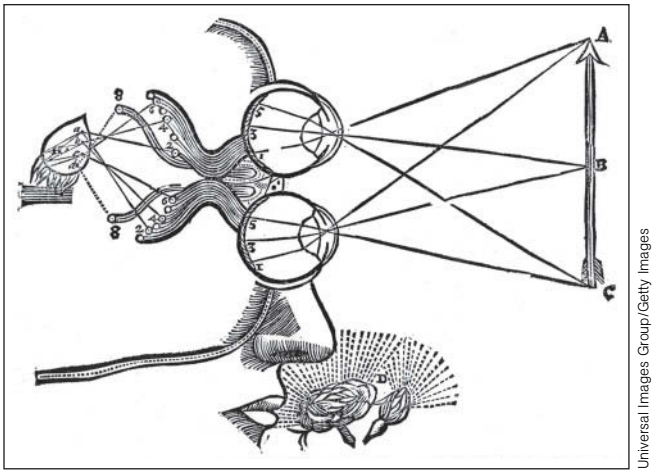
2

What was Descartes' version of dualism? How did it help pave the way for a science of psychology?

Before Descartes, most dualists assigned the interesting qualities of the human being to the soul. The soul was deemed responsible for the body's heat, for its ability to move, for life itself. In *Treatise of Man* (1637/1972), and even more explicitly in *The Passions of the Soul* (1649/1985), Descartes challenged this view. He was familiar with research on the flow of blood and began to regard the body as an intricate, complex machine that generates its own heat and is capable of moving, even without the influence of the soul. Although little was known about the nervous system in his time, Descartes' conception of the mechanical control of movement resembles our modern understanding of reflexes, which are involuntary responses to stimuli (see **Figure 1.1**).

Descartes believed that even quite complex behaviors can occur through purely mechanical means, without involvement of the soul. Consistent with church doctrine, he contended that nonhuman animals do not have souls, and he pointed out a logical implication of this contention: Any activity performed by humans that is qualitatively no different from the behavior of a nonhuman animal can, in theory, occur without

FIGURE 1.1 Descartes' depiction of a reflex Descartes believed that reflexes occur through purely mechanical means. In describing this figure, Descartes (1637/1972) suggested that the fire causes movement in the nearby particles of skin, pulling on a "thread" (that runs "C" to "C" along the back) going to the brain, which, in turn, causes a pore to open in the brain, allowing fluid to flow through a "small conduit" to the muscles that withdraw the foot. What Descartes called a "thread" and a "small conduit" are today called nerves, and we now know that nerves operate through electrical means, not through physical pulling or the shunting of fluids.



Universal Images Group/Getty Images

FIGURE 1.2 Descartes' depiction of how the soul receives information through the eyes Descartes believed that the human soul is housed in the pineal gland, depicted here as the tear-shaped structure in the center of the head. In describing this figure, Descartes (1637/1972) suggested that light from the arrow enters the eyes and opens pores in structures that we now know as the optic nerves. Fluid flows from the eyes through the opened pores, causing movement in the pineal gland, which, in Descartes' words, "renders the idea" of the arrow to the soul.

the soul. If my dog (who can do some wondrous things) is just a machine, then a good deal of what I do—such as eating, drinking, sleeping, running, panting, and occasionally going in circles—might occur purely mechanically as well.

In Descartes' view, the one essential ability that we have but dogs do not is *thought,* which Descartes defined as conscious deliberation and judgment. Whereas previous philosophers ascribed many functions to the soul, Descartes ascribed just one—thought. But even in his discussion of thought, Descartes tended to focus on the body's machinery. To be useful, thought must be responsive to the sensory input channeled into the body through the eyes, ears, and other sense organs, and it must be capable of directing the body's movements by acting on the muscles.

How can the thinking soul interact with the physical machine—the sense organs, muscles, and other parts of the body? Descartes suggested that the soul, though not physical, acts on the body at a particular physical location. Its place of action is a small organ (now known as the pineal body) buried between the two hemispheres (halves) of the brain (see **Figure 1.2**).

Thread-like structures, which we now call nerves or neurons, bring sensory information by physical means into the brain, where the soul receives the information and, by nonphysical means, thinks about it. On the basis of those thoughts, the soul then wills movements to occur and executes its will by triggering physical actions in nerves that, in turn, act on muscles. Descartes' dualism, with its heavy emphasis on the body, certainly helped open the door for a science of psychology.

3

What reasons can you think of for why Descartes' theory, despite its intuitive appeal, was unsuitable for a complete psychology?

Descartes' theory is popular among nonscientists even today because it acknowledges the roles of sense organs, nerves, and muscles in behavior without violating people's religious beliefs or intuitive feelings that conscious thought occurs on a nonphysical plane. But it has serious limitations, both as a philosophy and as a foundation for a science of psychology. As a philosophy, it stumbles on the question of how a nonmaterial entity (the soul) can have a material effect (movement of the body), or how the body can follow natural law and yet be moved by a soul that does not (Campbell, 1970). As a foundation for psychology, the theory sets strict limits, which few psychologists would accept today, on what can and cannot be understood scientifically. The whole realm of thought, and all behaviors that are guided by thought, are out of bounds for scientific analysis if they are the products of a willful soul.

Thomas Hobbes and the Philosophy of Materialism

4

How did Hobbes's materialism help lay the groundwork for a science of psychology?

At about the same time that Descartes was developing his machine-oriented version of dualism, an English philosopher named Thomas Hobbes (1588–1679) was going much further. In his book *Leviathan,* and in a shorter work called *Human Nature,* Hobbes argued that spirit, or soul, is a meaningless concept and that nothing exists but matter and energy, a philosophy now known as ***materialism.*** In Hobbes's view, all human behavior, including the seemingly voluntary choices we

make, can in theory be understood in terms of physical processes in the body, especially the brain. Conscious thought, he maintained, is purely a product of the brain's machinery and therefore subject to natural law. This philosophy places no theoretical limit on what psychologists might study scientifically. Most of Hobbes's work was directed toward the implications of materialism for politics and government, but his ideas helped inspire, in England, a school of thought about the mind known as empiricism, which we will discuss below.

Smithsonian Institution

A seventeenth-century mechanical man Mechanical clocks represented the pinnacle of technological achievement of the seventeenth century, comparable to computers today. For amusement, clock-like mechanisms were used to operate robotic, humanoid figures, as illustrated here. Such mechanical men helped to inspire, in Descartes and Hobbes, the idea that actual human beings might also operate by mechanical means, not requiring a nonmaterial spirit to move them.

Nineteenth-Century Physiology: Learning About the Machine

The idea that the body, including the brain, is a machine, amenable to scientific study, helped to promote the science of physiology—the study of the body's machinery. By the beginning of the nineteenth century, considerable progress had been made in this endeavor, and during that century discoveries were made about the nervous system that contributed significantly to the origins of scientific psychology.

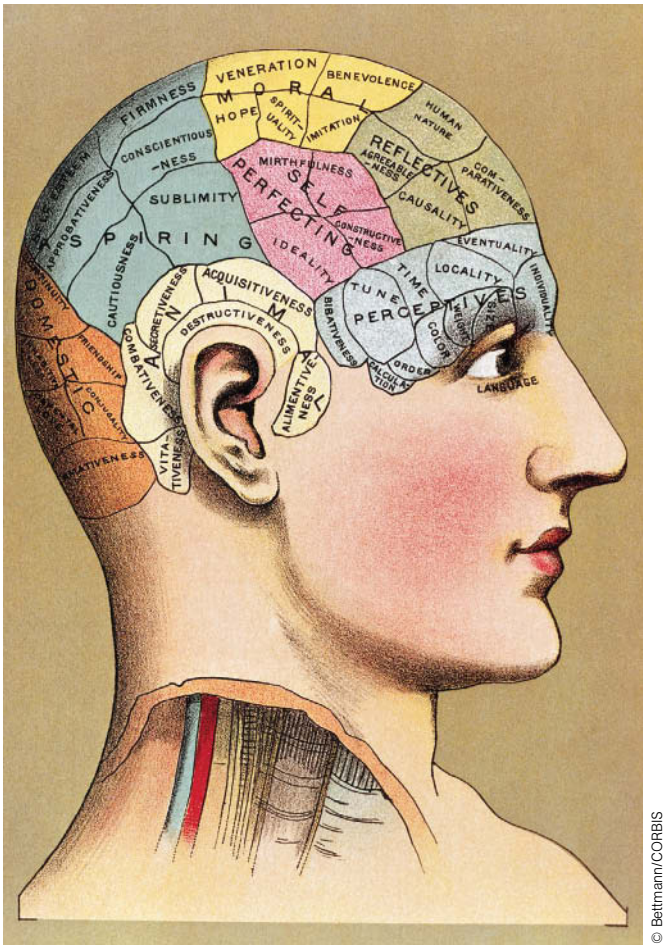
Increased Understanding of Reflexes One especially important development for the later emergence of psychology was an increased understanding of reflexes. The basic arrangement of the nervous system—consisting of a central nervous system (brain and spinal cord) and peripheral nerves that connect the central nervous system to sense organs and muscles—was well understood by the beginning of the nineteenth century. In 1822, the French physiologist François Magendie demonstrated that nerves entering the spinal cord contain two separate pathways: one for carrying messages into the central nervous system from the skin's sensory receptors and one for carrying messages out to operate muscles. Through experiments with animals, scientists began to learn about the neural connections that underlie simple reflexes, such as the automatic withdrawal response to a pinprick. They also found that certain brain areas, when active, could either enhance or inhibit such reflexes.

Some of these physiologists began to suggest that all human behavior occurs through reflexes—that even so-called voluntary actions are actually complex reflexes involving higher parts of the brain. One of the most eloquent proponents of this view, known as *reflexology,* was the Russian physiologist I. M. Sechenov. In his monograph *Reflexes of the Brain,* Sechenov (1863/1935) argued that every human action, "[b]e it a child laughing at the sight of toys, or. . . Newton enunciating universal laws and writing them on paper," can in theory be understood as a reflex. All human actions, he claimed, are initiated by stimuli in the environment. The stimuli act on a person's sensory receptors, setting in motion a chain of events in the nervous system that culminates in the muscle movements that constitute the action. Sechenov's work inspired another Russian physiologist, Ivan Pavlov (1849–1936), whose work on reflexes (discussed in Chapter 4) played a crucial role in the development of a scientific psychology.

5 **How did the nineteenth-century understanding of the nervous system inspire a theory of behavior called reflexology?**

The Concept of Localization of Function in the Brain Another important advance in nineteenth-century physiology was the concept of localization of function, the idea that specific parts of the brain serve specific functions in the production of mental experience and behavior. In Germany, Johannes Müller (1838/1965) proposed that the different qualities of sensory experience come about because the nerves from different sense organs excite different parts of

6 **How did discoveries of localization of function in the brain help establish the idea that the mind can be studied scientifically?**



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Localization of function taken to the extreme Work by Broca and others showed that particular cognitive functions, such as language, are controlled by specific areas of the brain. This led to the popular belief that all aspects of thought, emotion, and personality can be located in the brain, culminating in the pseudoscience known as *phrenology,* developed by the German physician Franz Joseph Galt. Galt and his followers believed that the mind consists of mental faculties that are located at specific sites in the brain. By feeling bumps on the skull, phrenologists claimed they could infer the size of various areas and describe a person's psychological characteristics. Although soundly discredited, phrenology influenced nineteenth-century psychiatry and is broadly consistent with modern neuroscience's idea of localization of function.

the brain. Thus we experience vision when one part of the brain is active, hearing when another part is active, and so on. In France, Pierre Flourens (1824/1965) performed experiments with animals showing that damage to different parts of the brain produces different kinds of deficits in animals' abilities to move. And Paul Broca (1861/1965), also in France, published evidence that people who suffer injury to a very specific area of the brain's left hemisphere lose the ability to speak but do not lose other mental abilities. All such evidence about the relationships between mind and brain helped to lay the groundwork for a scientific psychology because it gave substance to the idea of a material basis for mental processes.

The Idea That the Mind and Behavior Are Shaped by Experience

Besides helping to inspire research in physiology, the materialist philosophy of seventeenth-century England led quite directly to a school of thought about the mind known as *British empiricism,* carried on by such British philosophers as John Locke (1632–1704), David Hartley (1705–1759), James Mill (1773–1836), and John Stuart Mill (1806–1873). ***Empiricism,*** in this context, refers to the idea that human knowledge and thought derive ultimately from sensory experience (vision, hearing, touch, and so forth). If we are machines, we are machines that learn. Our senses provide the input that allows us to acquire knowledge of the world around us, and this knowledge allows us to think about that world and behave adaptively within it. The essence of empiricist philosophy is poetically

expressed in the following often-quoted passage from Locke's *An Essay Concerning Human Understanding* (1690/1975, p. 104):

> Let us suppose the mind to be, as we say, white paper, void of all characters, without any ideas; how comes it to be furnished? Whence comes it by that vast store, which the busy and boundless fancy of man has painted on it, with an almost endless variety? Whence has it all the materials of reason and knowledge? To this I answer, in one word, from experience. In that, all our knowledge is founded; and from that it ultimately derives itself.

Locke viewed a child's mind as a *tabula rasa,* or *blank slate,* and believed that experience serves as the chalk that writes on and fills the slate. The human brain has limitations, of course—we can't detect objects using echolocation as bats and dolphins can, for instance. But Locke argued that, outside of these extremes, children are born with no dispositions to make some types of learning easier than others, for example, or preferences to influence how they learn and develop. From this perspective, there is no "human nature" other than an ability to adapt one's behavior to the demands of the environment.

The Empiricist Concept of Association by Contiguity

In keeping with materialist philosophy, Locke and the other British empiricists argued that thoughts are not products of free will but rather reflections of a person's experiences in the physical and social environment. All the contents of the mind derive from the environment and bear direct relationship to that environment. According to the empiricists, the fundamental units of the mind are elementary ideas that derive directly from sensory experiences and become linked together, in lawful ways, to form complex ideas and thoughts.

7

How would you explain the origin of complex ideas and thoughts according to British empiricism? What role did the law of association by contiguity play in this philosophy?

The most basic operating principle of the mind's machinery, according to the empiricists, is the law of ***association by contiguity,*** an idea originally proposed by Aristotle in the fourth century BCE. *Contiguity* refers to closeness in space or time, and the law of association by contiguity can be stated as follows: If a person experiences two environmental events (stimuli, or sensations) at the same time or one right after the other (contiguously), those two events will become associated (bound together) in the person's mind such that the thought of one event will, in the future, tend to elicit the thought of the other.

As a simple illustration, consider a child's experiences when seeing and biting into an apple. In doing so, the child receives a set of sensations that produce in her mind such elementary ideas as red color, spherical shape, and sweet, tart taste. The child may also, at the same time, hear the sound *apple* emanating from the vocal cords of a nearby adult. Because all these sensations are experienced together, they become associated in the child's mind. Together, they form the complex idea "apple." Because of association by contiguity, the thought of any of the sensory qualities of the apple will tend to call forth the thought of all the apple's other sensory qualities. Thus, when the child hears *apple,* she will think of the red color, the spherical shape, and the sweet, tart taste. Or, when the child sees an apple, she will think of the sound *apple* and imagine the taste.

The empiricists contended that even their own most complex philosophical ponderings could, in theory, be understood as amalgams of elementary ideas that became linked together in their minds as a result of contiguities in their experiences. John Stuart Mill (1843/1875) referred to this sort of analysis of the mind as mental chemistry. Complex ideas and thoughts are formed from combinations of elementary ideas, much as chemical compounds are formed from combinations of chemical elements.

Inga Marchuk/Shutterstock

A complex idea To the empiricist philosophers, even the simple concept of "apple" is a complex idea, consisting of a set of elementary sensations—shape, color, and taste—that become associated in the person's mind through experiences with apples.