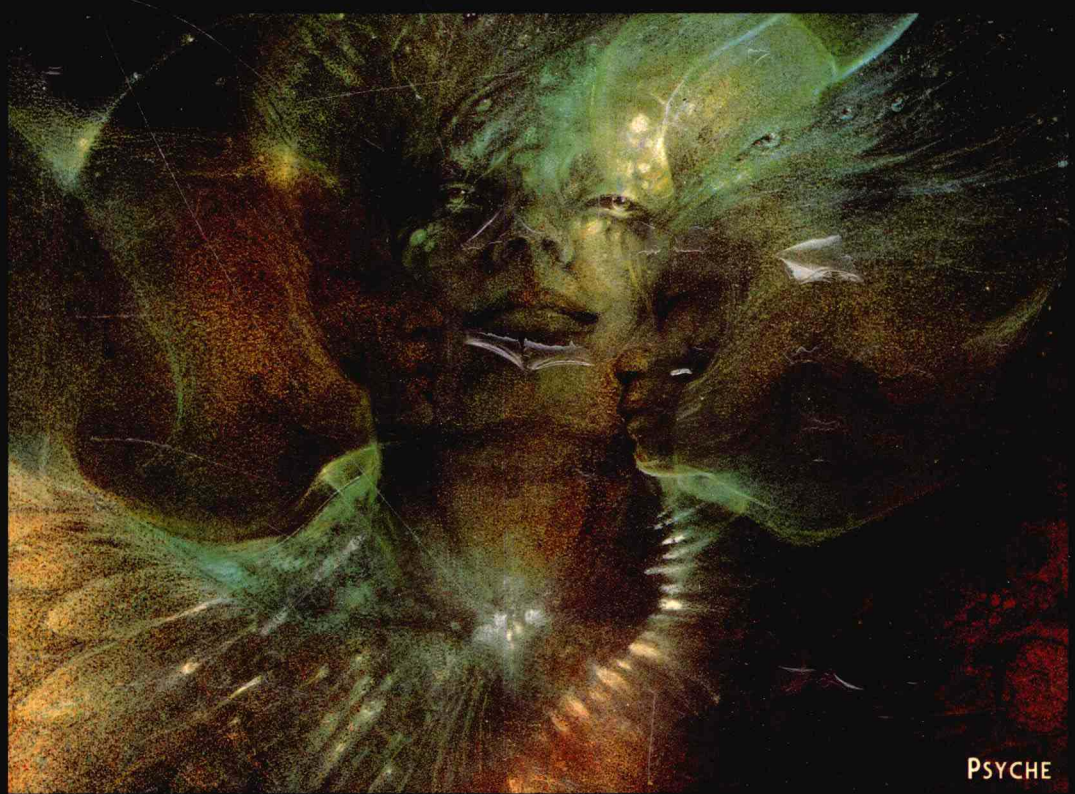
In Search of the HUMAN MIND



PSYCHE

ROBERT J. STERNBERG

In Search of the HUMAN MIND

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Yale University

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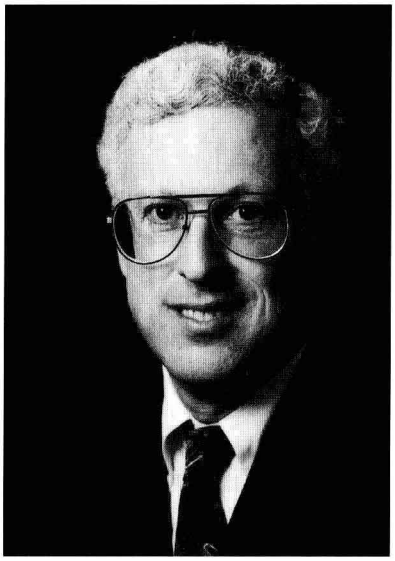
About the Author

Robert J. Sternberg is IBM Professor of Psychology and Education in the Department of Psychology at Yale University. He was graduated summa cum laude, Phi Beta Kappa, with a BA from Yale in 1972, receiving honors with exceptional distinction in psychology. He received the PhD in psychology in 1975 from Stanford University and an honorary doctorate from the Complutense University of Madrid in 1994.



Sternberg has won several scholarships and fellowships, including a National Merit Scholarship to attend Yale, where he won the Wohlenberg Prize; a National Science Foundation Fellowship to attend Stanford, where he received the Sidney Siegel Memorial Award; and a Guggenheim Fellowship while a faculty member at Yale. He also has won several other awards, including the Early Career and McCandless Awards of the American Psychological Association, the Outstanding Book and Research Review Awards of the American Educational Research Association, the Cattell Award of the Society of Multivariate Experimental Psychologists, and the International Award of the Association of Portuguese Psychologists. Sternberg is a Fellow of the American Psychological Association, American Psychological Society, and the American Association for the Advancement of Science.

Sternberg has been editor of the *Psychological Bulletin* and president of Divisions 1 (General Psychology) and 15 (Educational Psychology) of the American Psychological Association. He is the author of more than 400 books, book chapters, and articles, and has held more than $8 million in research grants and contracts.

About the Artists

Part One
Rebecca Ruegger notes, "Learning that Psyche had red hair, I wanted to portray that part of her physical being. I looked for an opportunity within the myth to illustrate this, and the talking reeds along the water's edge seemed to be the answer." She used watercolors on paper. Ruegger paints in a studio in her home on a small farm in Franklin, Tennessee.

Part Two
Trish Burgio writes, "I felt Psyche's constantly tumultuous environment is abstracted from her gentle personality." She used acrylics. Burgio paints and resides in Santa Monica, California.

Part Three
Terry Hoff explains, "My inspiration for the painting was to depict Psyche's searching for the elusive secrets common to the universal human experience." He used acrylics. Hoff has been a successful illustrator for 10 years. He works and resides in Pacifica, California.

Part Four
Kathleen Kinkopf writes, "I was naturally drawn to Psyche's struggle in the gathering of the golden fleece. The thought of the evil sheep seemed to be such a dichotomy. This is where I felt her goodness alone had protected her from evil." She used pastels. Kinkopf is a commercial illustrator and runs a gallery in Breckenridge, Colorado.

Part Five
Theresa Smith notes, "When I read the Psyche myth it became clear to me the fundamental attitudes that mothers portray toward their sons and their sons' objects of desire. Jealousy, betrayal, and revenge are insidious throughout the myth. All to end with the one aspect that is true to real life, that everyone just wants to be loved." She used oil pastels and colored pencils. Smith lives in Tucson, Arizona, where she maintains her freedom through her fine art, illustration, design, and computer animation.

Part Six
Arden von Haeger explains, "I tried to capture the scene when Psyche went to the summit of the rocky hill, alone, to await the winged serpent. There is the feeling of her dark despair and loneliness, only for her to be lifted, in the end, by the Zephyr winds into the arms of the god of love." He created the image with chalk pastels on German sandpaper. Von Haeger is a freelance illustrator based in Nashville, Tennessee.

PREFACE

In Search of the Human Mind is the product of a purpose and a passion: to teach students to understand and to think as psychologists do. It is the course I wish that I had taken when I studied Introductory Psychology.

Embracing equally the biological, cognitive, developmental, social, and clinical paradigms, the content is rigorous yet thoroughly readable. It is theory- and research-based, with pedagogical features that encourage students to apply the results of that research. The twenty chapters are organized into six parts, addressing the nature of psychology, basic biological and cognitive processes, higher cognitive processes, developmental processes, social psychological processes, and clinical processes. A statistical appendix demonstrates statistical methods by having students survey their classmates and analyze those data. A glossary fully defines key terms from the text, and a comprehensive reference list as well as detailed name and subject indexes complete the back matter.

This book focuses on three closely related themes: higher order thinking, the evolution of ideas, and integration. Through these themes, students come to understand psychology not as a static field but as a dynamic, evolving science. Students learn better and understand more because they understand the context of what they learn, not just a set of isolated facts.

HIGHER ORDER THINKING *In Search of the Human Mind* teaches students not only the facts and ideas they need to be psychologists but also how to think critically about these facts. This book's higher order thinking approach is much broader and far more useful than those of other textbooks. Whereas some books ask students to think analytically about isolated questions, *In Search of the Human Mind* asks students to think three ways—analytically, creatively, and practically—about not only a wide range of psychological issues but also how their own personal experiences relate to those issues.

The theory of pedagogy underlying the book derives from my own triarchic theory of human intelligence, but you need not accept this particular theory or any other to realize the value of students learning the facts and learning to think analytically, creatively, and practically with these facts. To be a psychologist—researcher, practitioner, or teacher—one needs to think about psychology in all three of these ways. Moreover, each student has a different, preferred style of learning and thinking about psychology. By teaching the facts and how to think about them in three different ways, you will find that, as a teacher, you will reach far more students than you ever have before. I know, because that is how I came to teach both my freshman undergraduates at Yale and the advanced-placement high school students who have come to the summer program at Yale that I designed according to this model. I have seen firsthand the difference this approach makes. In addition, class testing by Harcourt Brace showed that students preferred this book 2 to 1 over the market leader.

The textbook teaches students to think critically by providing two forms of prompting questions in each chapter: *In Search of . . .* questions, located at the beginning of major sections, ask students to think globally about the major issues of the chapter; and *triarchic questions*, scattered throughout the sections and at the end of each chapter and part, ask students to draw upon their own experiences and to think analytically, creatively, or practically about specific concepts. The text also models critical analyses of research and theories and highlights the critical processes that researchers go through as they refine their theories.

EVOLUTION OF IDEAS: DIALECTIC Critical thought is at the core of psychological research. For students to think about ideas as psychologists do, students need to understand how those ideas have come about. A key emphasis in this book, therefore, is on the evolution of ideas in psychology. *In Search of the Human Mind* emphasizes the dialectical progression of psychology: from one point of view, to an opposing view, to a synthesis of the two, which then becomes the basis for a new point of view to be opposed. The dialectical approach both enables students to understand the current theories in psychology and provides a framework for students to understand the shifts in emphasis over time among the biological, cognitive, developmental, social, and clinical paradigms.

INTEGRATION To support the universal perspective of dialectic, the text carefully integrates, generalizes, and applies the topics and theories of each chapter to all other related chapters. It encourages students to generalize their knowledge of psychology to other experiences by relating text material to other disciplines and by showing how those disciplines also progress through a dialectic. Because the field of psychology is embedded not only in its own historical antecedents but in other disciplines as well, the integrated approach allows psychology to come alive through numerous literary quotes, works of art, and examples from the natural sciences. In this way, students with interests in other disciplines as well as those whose primary interest is in psychology will see how psychology relates to the myriad ways of thinking about people and the world.

Students learn to think about psychology in a global perspective not only through the relation of key ideas to work in other disciplines, but also through the use of numerous multicultural and cross-cultural examples. My own research has looked at thinking both multiculturally—as when I have compared the conceptions of intelligence of different ethnic groups—and cross-culturally—as when I have studied effects of parasitic infections on the thinking of Jamaican schoolchildren. By studying problems beyond narrow groups of subjects, one learns to appreciate not just how complex these problems are, but how better they can be approached for solution. Just as problems need to be studied in their many contexts, so do people.

PEDAGOGY See the preface "To the Student" for illustrations and descriptions of the many pedagogical features, which include chapter outlines, triarchic questions, key terms, *Searchers* boxes, an extensive illustration program, a point-by-point chapter summary, and *Charting the Dialectic* part summaries.

DESIGN The design is an integral part of *In Search of the Human Mind*, reinforcing the book's many strong features. The design uses two primary symbols to unify the book: Psyche, the mythical soul and the symbol for psychology; and the dialectical tree. Psyche, whose image appears on the cover and whose myth is explained on the inside front cover, appears on each of the part openers. Each part image presents a different artist's interpretation of the myth of Psyche, the different interpretations themselves representing a form of dialectic. (See the artists' own comments about their interpretations in the "About the Artists" section, page vi.) Psyche's lamp is featured prominently in the broad *In Search of . . .* questions in the chapters. The dialectical tree, on the inside back cover, illustrates the evolution of psychology from its roots to its present myriad branches. The tree image is echoed in each chapter and is highlighted in the dialectical discussions at the end of each part.

To continue the unified theme of critical thinking, the design also uses three secondary symbols, which represent the elements of the triarchic theory of intelligence. Rodin's *Thinker* symbolizes analytic thinking, an artist's palette symbolizes creative thinking, and a wheel symbolizes practical thinking. The symbols identify the type of each triarchic question both in the chapters and the parts.

ANCILLARY PACKAGE

In support of *In Search of the Human Mind*, the ancillary package builds on solid pedagogical theory to serve the needs of the Introductory Psychology student and instructor and to take full advantage of the latest in technology.

- The **Study Guide** by Bernard C. Beins (Ithaca College) is rigorously designed to mirror the features of the text. Each chapter lists specific goals and objectives, helps students review the material through fill-in-the-blank questions, reinforces terminology with matching exercises, and encourages students to synthesize the information through short-answer questions of varied rigor that reflect the triarchic theory. Finally, the Study Guide provides two practice tests per chapter.

As an APA fellow and secretary of Division Two, Teaching of Psychology, Bernard Beins is involved extensively with the issues regarding the Introductory Psychology course. He has published numerous articles and has given various presentations on the subject of enhancing the learning experience.

- The **Instructor's Manual** has been created by Edward P. Kardas (Southern Arkansas University). Its vast resources, designed to assist both new and experienced instructors, include hints on how to integrate critical thinking into the classroom, chapter goals and objectives that directly reflect those in the Study Guide, lecture suggestions and notes to enhance lectures, reading suggestions, demonstrations, video resources with a brief description of the content, as well as numerous exercises and handouts to encourage the student to think critically along the lines of the triarchic theory. A discussion of how to utilize the

computer and Internet in teaching is unique to this manual.

Edward Kardas is chair of the APA Division Two taskforce on secondary and undergraduate psychology.

• The **Testbank** closely supports the theme of critical thinking from the textbook, the Study Guide, and the Instructor's Manual. Each chapter provides 180 convergent, multiple-choice items and 45 divergent, short-essay items. Two-thirds of the convergent items are conceptual (the remaining one-third are factual), and all are rated by difficulty and keyed to the section and the page in the textbook where the concept is discussed. The divergent items ask students to answer questions in essay format to bring out the triarchic forms of thinking. Answer guidelines give instructors key concepts to look for in the students' essays.

Closely reviewed by Robert Sternberg and Dennis Cogan (Texas Tech University), the testbank chapters were written by a panel of experienced instructors, including Stuart Korshavn (St. Norbert College), Terry Blumenthal (Wake Forest University), Paul Wellman (Texas A&M University), George Cicala (University of Delaware), Susan Davis (Loras College), Susan Lima (University of Wisconsin), Fran Spencer (Towson State University), Carolyn Mangelsdorf (University of Washington), Josephine Wilson (Wittenberg University), and Stephen Buggie (Presbyterian College).

Computerized versions of the testbank are available in DOS 3.5-inch, DOS 5.25-inch, Windows, and Macintosh versions. The testbank software, *EXAMaster+*™ offers three unique features to the instructor. *EasyTest* creates a test from a single screen in just a few easy steps. Instructors choose parameters, then either select questions from the database or let EasyTest randomly select them. *FullTest* offers a range of options that includes selecting, editing, adding, or linking questions or graphics; random selection of questions from a wide range of criteria; creating criteria; blocking questions; and printing up to 99 different versions of the same test and answer sheet. *EXAMRecord*™ records, curves, graphs, and prints out grades according to criteria the instructor selects. Grade distribution displays as a bar graph or plotted graph.

For the instructor without access to a computer or who has questions about the software, Harcourt Brace College Publishers (800-447-9457) offers two services. *RequesTest* provides a software specialist who will compile questions according to the instructor's criteria and mail or fax the test master within 48 hours. The *Software Support Hotline* is available to answer questions Monday through Friday, 9 a.m. to 4 p.m., Central time.

• The **Overhead Transparencies** come in two packages: 75 illustrations and tables, specially selected from *In Search of the Human Mind* by Paul Chara (Loras College), supplement the more than 200 transparencies in the Harcourt Brace Introductory Psychology Transparency package. Each acetate, with accompanying guide, is in full color.

Multimedia and Interactive Software

• **Harcourt Interactive, *Psychology: The Core on CD-ROM,*** prepared by John Mitterer (Brock University), is an innovative learning tool that allows students to explore and understand the realm of psychology in an interactive, multimedia environment. Mini-lectures, covering the key concepts in every chapter, include video footage, animation, and experiments, and are linked directly to the full text, which also appears on the CD-ROM. In addition, the CD-ROM allows students to test their mastery of the material via a series of test questions hyperlinked to the relevant sections of *In Search of the Human Mind.*

Mitterer, who has been praised for his authorship of Harcourt Brace's videodisc, *Dynamic Concepts in Psychology,* has coordinated the creation of the CD-ROM with the help of such experienced lecturers as Tom Brothen (University of Minnesota), Bill Buskist (Auburn University), Paula Goolkasian (University of North Carolina, Charlotte), Carolyn Meyer (Lake Sumter Community College), David Murphy (Waubonsee Community College), and Robert Patterson (Washington State University).

• ***Dynamic Concepts in Psychology,*** a highly successful videodisc developed by John Mitterer (Brock University), covers every major concept of Introductory Psychology. Media include animated sequences, video footage, still images, and demonstrations of well-known experiments. Adhesive bar codes facilitate quick access to images during lectures, and a modular format allows instructors to tailor the program to their course. Level III software gives instructors the ability to preprogram classroom presentations and to import material from other videodiscs (DOS, Macintosh).

• ***Discovering Psychology,*** a video series, is an Introductory Psychology course hosted by Philip Zimbardo, comprising 26 half-hour programs on 13 one-hour tapes. The *Teaching Modules* provide con-

densed versions of the programs, comprising 15 15-minute units. An Instructor's Guide provides descriptions and teaching suggestions. The program is available on videotape or videodisc.

• ***LectureActive*** software, which accompanies the videodiscs, enables instructors to create custom lectures swiftly and simply.

• ***Infinite Voyage,*** a videodisc series, incorporates on-location, interview, laboratory, and candid footage produced by WQED of Pittsburgh to provide compelling coverage of high-interest topics in psychology.

• ***Harcourt Brace Quarterly: A Video News Magazine,*** produced with CBS Television, brings current psychological applications from today's headlines into your classroom. One-hour videos are compiled from the *CBS Nightly News*, *CBS This Morning*, *48 Hours*, and *Street Stories with Ed Bradley*. Instructors' Notes summarize each 2- to 5-minute segment. (Segments from *48 Hours* and *Street Stories* may be longer.)

• ***The Brain*** teaching modules compile key segments of the PBS series *The Brain* into 30 video modules of about 6 minutes each.

• ***The Mind*** video modules, developed by Frank Vattano (Colorado State University, Fort Collins) in cooperation with WNET of New York, offer selections from the PBS series *The Mind* to illustrate important concepts in Introductory Psychology.

• ***Personal Discovery*** provides a computerized series of self-description, self-exploration, and extended personal planning activities to help the student apply psychological principles to life (DOS, Macintosh).

• ***The Psychology Experimenter*** enables individuals or groups to create, design, modify, and conduct experiments. The resulting data can be saved, displayed, and printed (DOS).

• ***Supershrink I and II,*** developed by Joseph Lowman (University of North Carolina, Chapel Hill), introduces students to clinical interviewing techniques by allowing them to take the role of a helpline crisis volunteer with clients Victor *(Supershrink I)* and Jennifer *(Supershrink II)* (DOS).

• ***PsychLearn*** provides five experiments in which the student participates as subject (DOS, Macintosh).

• ***BrainStack,*** an interactive self-guided tour to the human cerebral cortex, includes a self-study quiz and an on-line index (Macintosh).

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I would like especially to thank my Introductory Psychology students for putting up with me over the years as I tried out the materials in class. My undergraduate advisor, Endel Tulving, and my graduate advisor, Gordon Bower, both profoundly affected how I think about psychology, as did Wendell Garner as a faculty mentor at Yale.

Finally, I thank my wife, Alejandra Campos; my children, Seth and Sara; and my group of collaborators at Yale for the support they have always shown me in my work.

RJS

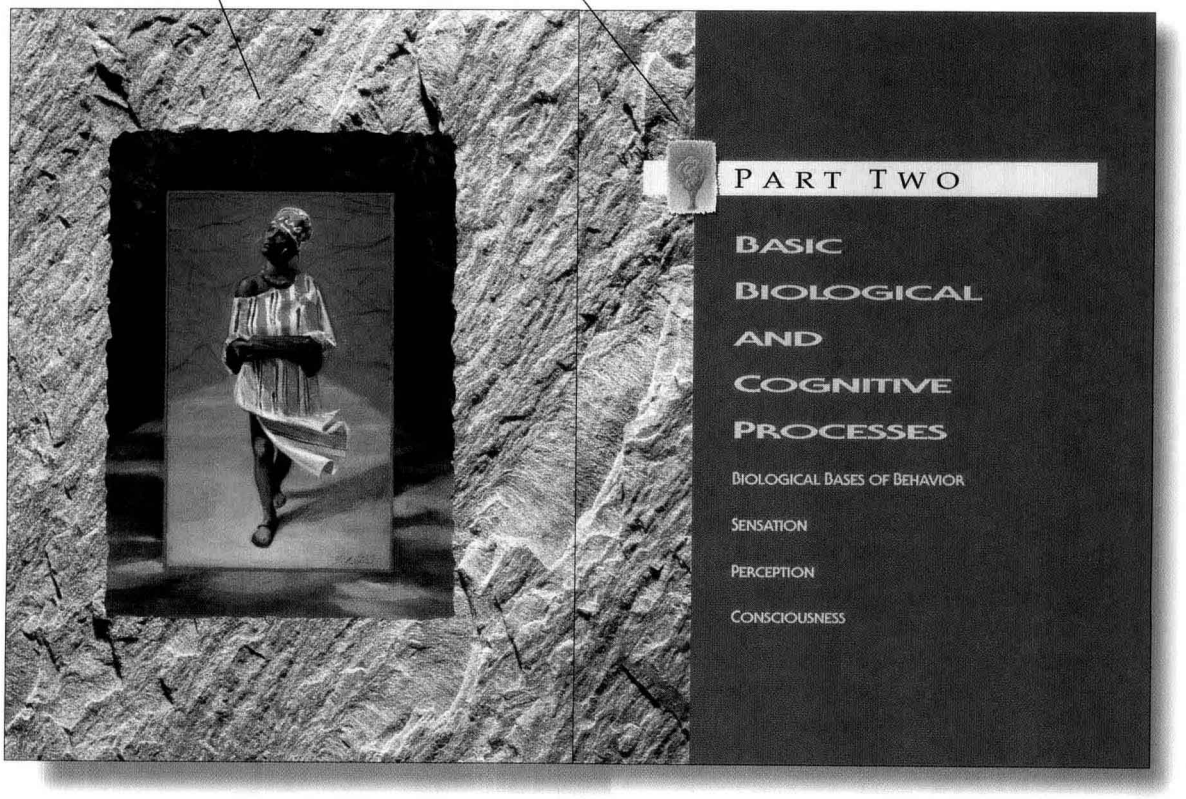
STUDENT PREFACE

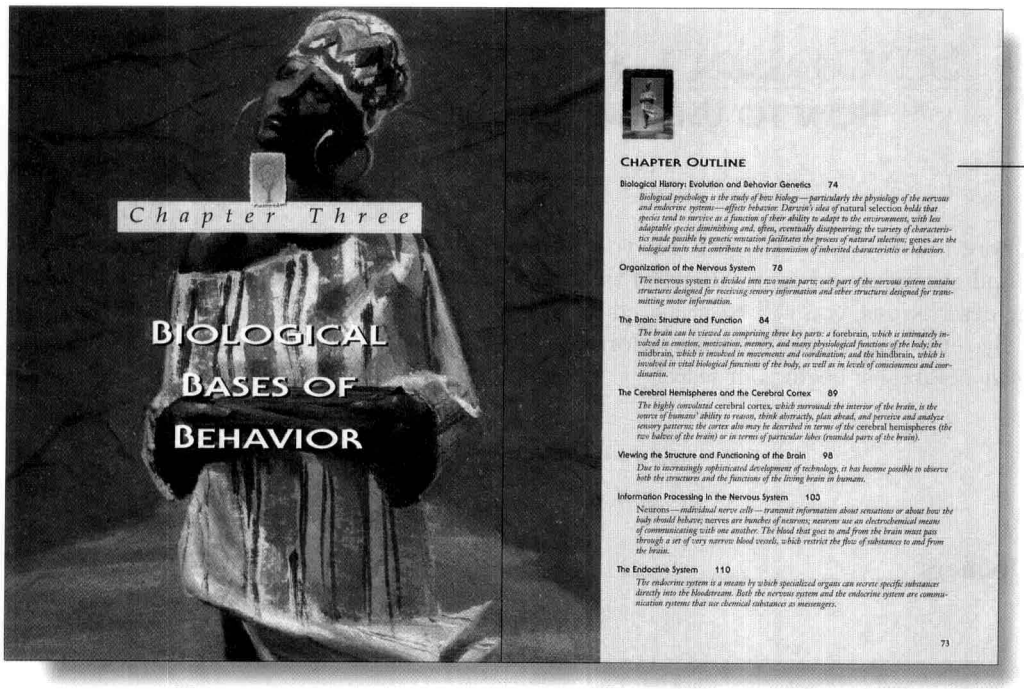
HOW TO USE THIS TEXTBOOK

To make your course more rewarding, we suggest that you review the following pages prepared especially for you. In them you will find examples and explanations of the organizational structure of *In Search of the Human Mind.* After reading the descriptions, you will be prepared to take full advantage of the learning tools that have been designed for you. By reviewing the organization before you enter the first chapter, you will have the advantage of having *seen the map* before you begin your search.

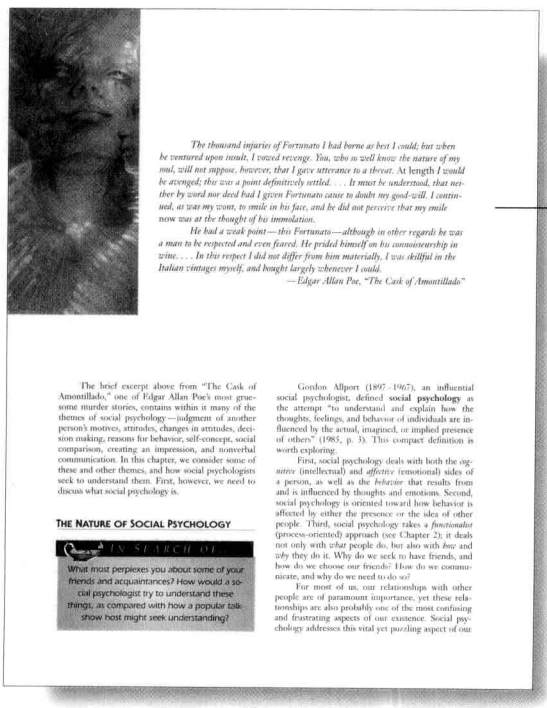
Part and Chapter Openers

Each **part opener** within *In Search of the Human Mind* shows a different artist's interpretation of the myth of Psyche and outlines the topics within that part.





An annotated **chapter outline** opens each chapter, providing a brief introduction to the content of each major section and thus a general context for understanding the chapter.



The thousand injuries of Fortunato I had borne as best I could; but when he ventured upon insult, I vowed revenge. You, who so well know the nature of my soul, will not suppose, however, that I gave utterance to a threat. At length *I would be avenged; this was a point definitively settled. . . . It must be understood, that neither by word nor deed had I given Fortunato cause to doubt my good-will. I continued, as was my wont, to smile on his face, and he did not perceive that my smile now was at the thought of his immolation.*

He had a weak point—this Fortunato—although in other regards he was a man to be respected and even feared. He prided himself on his connoisseurship in wine. . . . In this respect I did not differ from him materially. I was skillful in the Italian vintages myself, and bought largely whenever I could.

—Edgar Allan Poe, "The Cask of Amontillado"

The brief excerpt above from "The Cask of Amontillado," one of Edgar Allan Poe's most gruesome murder stories, contains within it many of the themes of social psychology—judgment of another person's motives, attitudes, changes in attitudes, decision making, reasons for behavior, self-concept, social comparison, creating an impression, and nonverbal communication. In this chapter, we consider some of these and other themes, and how social psychologists seek to understand them. First, however, we need to discuss what social psychology is.

THE NATURE OF SOCIAL PSYCHOLOGY

IN SEARCH OF . . .

What most perplexes you about some of your friends and acquaintances? How would a social psychologist try to understand these things, as compared with how a popular talk show host might seek understanding?

Gordon Allport (1897–1967), an influential social psychologist, defined **social psychology** as the attempt "to understand and explain how the thoughts, feelings, and behavior of individuals are influenced by the actual, imagined, or implied presence of others" (1985, p. 3). This compact definition is worth exploring.

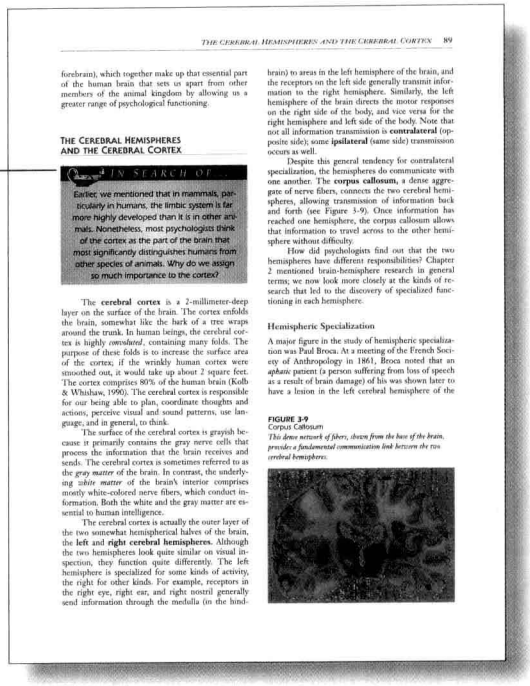
First, social psychology deals with both the *cognitive* (intellectual) and *affective* (emotional) sides of a person, as well as the *behavior* that results from and is influenced by thoughts and emotions. Second, social psychology is oriented toward how behavior is affected by either the presence or the idea of other people. Third, social psychology takes a *functionalist* (process-oriented) approach (see Chapter 2); it deals not only with *what* people do, but also with *how* and *why* they do it. Why do we seek to have friends, and how do we choose our friends? How do we communicate, and why do we need to do so?

For most of us, our relationships with other people are of paramount importance, yet these relationships are also probably one of the most confusing and frustrating aspects of our existence. Social psychology addresses this vital yet puzzling aspect of our

A **vignette** opens each chapter, setting a mood or context and showing how the psychological principles of the chapter apply to everyday life. Here, an excerpt from *The Cask of Amontillado* by Edgar Allan Poe introduces Chapter 14's presentation of social psychology.

Higher Order Thinking

In Search of . . . questions, designated by Psyche's lamp, introduce major concepts in each chapter in a way that encourages you to explore how they relate to common experiences.


THE CEREBRAL HEMISPHERES AND THE CEREBRAL CORTEX 89

forebrain), which together make up that essential part of the human brain that sets us apart from other members of the animal kingdom by allowing us a greater range of psychological functioning.

THE CEREBRAL HEMISPHERES AND THE CEREBRAL CORTEX

IN SEARCH OF

Earlier, we mentioned that in mammals, particularly in humans, the limbic system is far more highly developed than it is in other animals. Nonetheless, most psychologists think of the cortex as the part of the brain that most significantly distinguishes humans from other species of animals. Why do we assign so much importance to the cortex?

The **cerebral cortex** is a 2-millimeter-deep layer on the surface of the brain. The cortex enfolds the brain, somewhat like the bark of a tree wraps around the trunk. In human beings, the cerebral cortex is highly *convoluted*, containing many folds. The purpose of these folds is to increase the surface area of the cortex; if the wrinkly human cortex were smoothed out, it would take up about 2 square feet. The cortex comprises 80% of the human brain (Kolb & Whishaw, 1990). The cerebral cortex is responsible for our being able to plan, coordinate thoughts and actions, perceive visual and sound patterns, use language, and in general, to think.

The surface of the cerebral cortex is grayish because it primarily contains the gray nerve cells that process the information that the brain receives and sends. The cerebral cortex is sometimes referred to as the *gray matter* of the brain. In contrast, the underlying *white matter* of the brain's interior comprises mostly white-colored nerve fibers, which conduct information. Both the white and the gray matter are essential to human intelligence.

The cerebral cortex is actually the outer layer of the two somewhat hemispherical halves of the brain, the **left** and **right cerebral hemispheres**. Although the two hemispheres look quite similar on visual inspection, they function quite differently. The left hemisphere is specialized for some kinds of activity, the right for other kinds. For example, receptors in the right eye, right ear, and right nostril generally send information through the medulla (in the hindbrain) to areas in the left hemisphere of the brain, and the receptors on the left side generally transmit information to the right hemisphere. Similarly, the left hemisphere of the brain directs the motor responses on the right side of the body, and vice versa for the right hemisphere and left side of the body. Note that not all information transmission is **contralateral** (opposite side); some **ipsilateral** (same side) transmission occurs as well.

Despite this general tendency for contralateral specialization, the hemispheres do communicate with one another. The **corpus callosum,** a dense aggregate of nerve fibers, connects the two cerebral hemispheres, allowing transmission of information back and forth (see Figure 3-9). Once information has reached one hemisphere, the corpus callosum allows that information to travel across to the other hemisphere without difficulty.

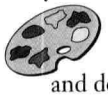
How did psychologists find out that the two hemispheres have different responsibilities? Chapter 2 mentioned brain-hemisphere research in general terms; we now look more closely at the kinds of research that led to the discovery of specialized functioning in each hemisphere.

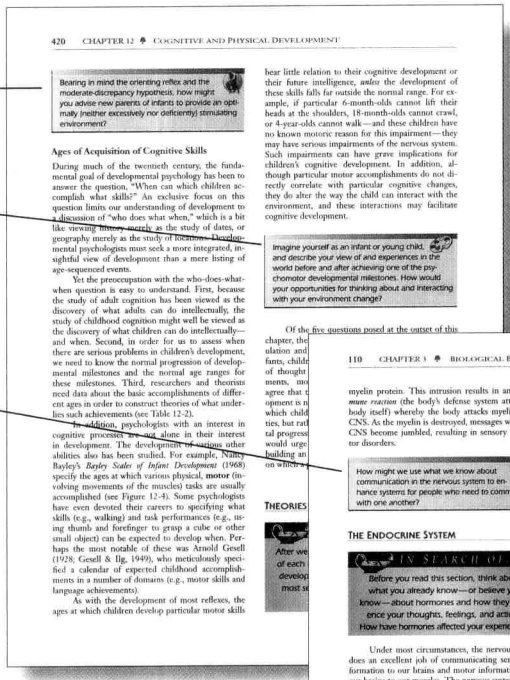
Hemispheric Specialization

A major figure in the study of hemispheric specialization was Paul Broca. At a meeting of the French Society of Anthropology in 1861, Broca noted that an *aphasic* patient (a person suffering from loss of speech as a result of brain damage) of his was shown later to have a lesion in the left cerebral hemisphere of the

FIGURE 3-9
Corpus Callosum
This dense network of fibers, shown from the base of the brain, provides a fundamental communication link between the two cerebral hemispheres.

Triarchic questions scattered throughout the text encourage you to think about concepts and apply your own experiences in three ways. Questions identified by Rodin's *Thinker* ask you to think analytically, to analyze, compare and contrast, and evaluate facts and ideas. Questions identified by an artist's palette ask you to think creatively, to discover, invent, and design—to go beyond what you already know or do. And questions identified by a wheel ask you to think practically, to apply what you have learned and to think about how to use the information in your everyday life. (See these questions also at the end of each chapter.)




420 CHAPTER 12 COGNITIVE AND PHYSICAL DEVELOPMENT

Bearing in mind the orienting reflex and the moderate-discrepancy hypothesis, how might you advise new parents of infants to provide an optimally (neither excessively nor deficiently) stimulating environment?

Ages of Acquisition of Cognitive Skills

During much of the twentieth century, the fundamental goal of developmental psychology has been to answer the question, "When can which children accomplish what skills?" An exclusive focus on this question limits our understanding of development to a discussion of "who does what when," which is a bit like viewing history merely as the study of dates, or geography merely as the study of locations. Developmental psychologists must seek a more integrated, insightful view of development than a mere listing of age-sequenced events.

Yet the preoccupation with the who-does-what-when question is easy to understand. First, because the study of adult cognition has been viewed as the discovery of what adults can do intellectually, the study of childhood cognition might well be viewed as the discovery of what children can do intellectually—and when. Second, in order for us to assess when there are serious problems in children's development, we need to know the normal progression of developmental milestones and the normal age ranges for these milestones. Third, researchers and theorists need data about the basic accomplishments of different ages in order to construct theories of what underlies such achievements (see Table 12-2).

In addition, psychologists with an interest in cognitive processes are not alone in their interest in development. The development of various other abilities also has been studied. For example, Nancy Bayley's *Bayley Scales of Infant Development* (1968) specify the ages at which various physical, **motor** (involving movements of the muscles) tasks are usually accomplished (see Figure 12-4). Some psychologists have even devoted their careers to specifying what skills (e.g., walking) and task performances (e.g., using thumb and forefinger to grasp a cube or other small object) can be expected to develop when. Perhaps the most notable of these was Arnold Gesell (1928; Gesell & Ilg, 1949), who meticulously specified a calendar of expected childhood accomplishments in a number of domains (e.g., motor skills and language achievements).

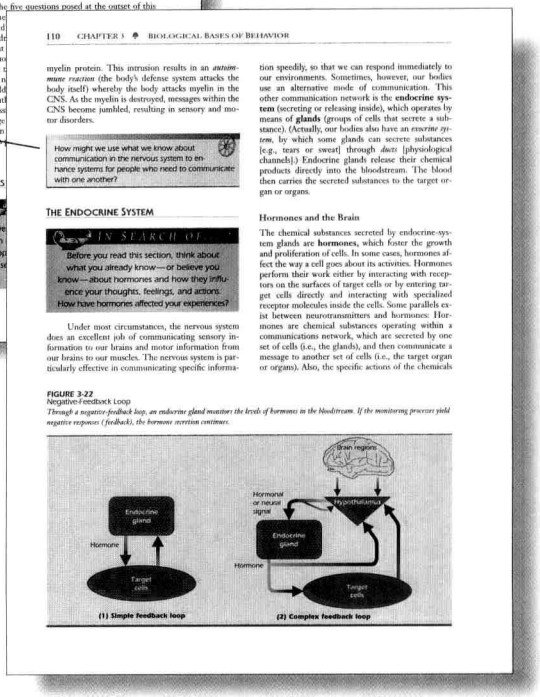
As with the development of most reflexes, the ages at which children develop particular motor skills bear little relation to their cognitive development or their future intelligence, *under* the development of these skills falls far outside the normal range. For example, if particular 6-month-olds cannot lift their heads at the shoulders, 18-month-olds cannot crawl, or 4-year-olds cannot walk—and these children have no known motoric reason for this impairment—they may have serious impairments of the nervous system. Such impairments can have grave implications for children's cognitive development. In addition, although particular motor accomplishments do not directly correlate with particular cognitive changes, they do alter the way the child can interact with the environment, and these interactions may facilitate cognitive development.

Imagine yourself as an infant or young child, and describe your view of and experiences in the world before and after achieving one of the psychomotor developmental milestones. How would your opportunities for thinking about and interacting with your environment change?

Of the five questions posed at the outset of this chapter, the

THEORIES

After we of each develop most s


110 CHAPTER 3 BIOLOGICAL BASES OF BEHAVIOR

myelin protein. This intrusion results in an *autoimmune reaction* (the body's defense system attacks the body itself) whereby the body attacks myelin in the CNS. As the myelin is destroyed, messages within the CNS become jumbled, resulting in sensory and motor disorders.

How might we use what we know about communication in the nervous system to enhance systems for people who need to communicate with one another?

THE ENDOCRINE SYSTEM

IN SEARCH OF

Before you read this section, think about what you already know—or believe you know—about hormones and how they influence your thoughts, feelings, and actions. How have hormones affected your experiences?

Under most circumstances, the nervous system does an excellent job of communicating sensory information to our brains and motor information from our brains to our muscles. The nervous system is particularly effective in communicating specific information speedily, so that we can respond immediately to our environments. Sometimes, however, our bodies use an alternative mode of communication. This other communication network is the **endocrine system** (secreting or releasing inside), which operates by means of **glands** (groups of cells that secrete a substance). (Actually, our bodies also have an *exocrine system*, by which some glands can secrete substances [e.g., tears or sweat] through *ducts* [physiological channels].) Endocrine glands release their chemical products directly into the bloodstream. The blood then carries the secreted substances to the target organ or organs.

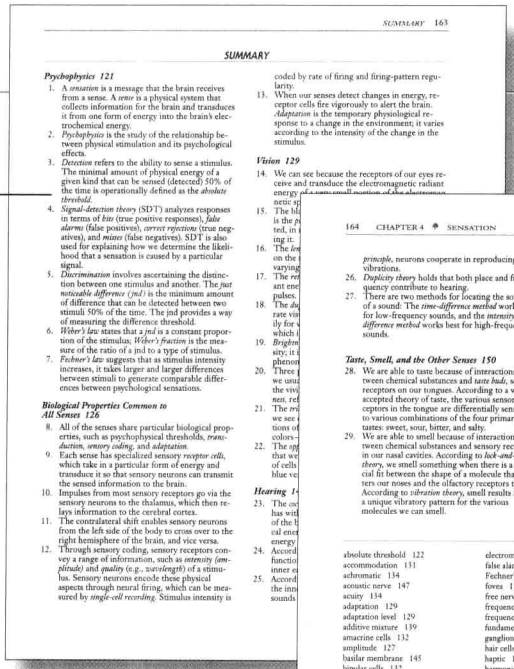
Hormones and the Brain

The chemical substances secreted by endocrine-system glands are **hormones,** which foster the growth and proliferation of cells. In some cases, hormones affect the way a cell goes about its activities. Hormones perform their work either by interacting with receptors on the surfaces of target cells or by entering target cells directly and interacting with specialized receptor molecules inside the cells. Some parallels exist between neurotransmitters and hormones: Hormones are chemical substances operating within a communications network, which are secreted by one set of cells (i.e., the glands), and then communicate a message to another set of cells (i.e., the target organ or organs). Also, the specific actions of the chemicals

FIGURE 3-22
Negative-Feedback Loop
Through a negative-feedback loop, an endocrine gland monitors the levels of hormones in the bloodstream. If the monitoring process yields negative responses (feedback), the hormone secretion continues.

End of the Chapters and Parts

A **point-by-point summary,** organized by chapter sections, briefly reviews the material and the key terms within those sections.



SUMMARY 163

SUMMARY

Psychophysics 121

1. *A sensation* is a message that the brain receives from a sense. A *sense* is a physical system that collects information for the brain and transduces it from one form of energy into the brain's electrochemical energy.
2. *Psychophysics* is the study of the relationship between physical stimulation and its psychological effects.
3. *Detection* refers to the ability to sense a stimulus. The minimal amount of physical energy of a given kind that can be sensed (detected) 50% of the time is operationally defined as the *absolute threshold.*
4. *Signal-detection theory* (SDT) analyzes responses in terms of *hits* (true positive responses), *false alarms* (false positives), *correct rejections* (true negatives), and *misses* (false negatives). SDT is also used for explaining how we determine the likelihood that a sensation is caused by a particular signal.
5. *Discrimination* involves ascertaining the distinction between one stimulus and another. The *just noticeable difference (jnd)* is the minimum amount of difference that can be detected between two stimuli 50% of the time. The jnd provides a way of measuring the difference threshold.
6. *Weber's law* states that a *jnd* is a constant proportion of the stimulus; *Weber's fraction* is the measure of the ratio of a jnd to a type of stimulus.
7. *Fechner's law* suggests that as stimulus intensity increases, it takes larger and larger differences between stimuli to generate comparable differences between psychological sensations.

Biological Properties Common to All Senses 126

8. All of the senses share particular biological properties, such as psychophysical thresholds, *transduction, sensory coding,* and *adaptation.*
9. Each sense has specialized sensory *receptor cells,* which take in a particular form of energy and transduce it so that sensory neurons can transmit the sensed information to the brain.
10. Impulses from most sensory receptors go via the sensory neurons to the thalamus, which then relays information to the cerebral cortex.
11. The contralateral shift enables sensory neurons from the left side of the body to cross over to the right hemisphere of the brain, and vice versa.
12. Through sensory coding, sensory receptors convey a range of information, such as *intensity (amplitude)* and *quality* (e.g., *wavelength*) of a stimulus. Sensory neurons encode these physical aspects through neural firing, which can be measured by *single-cell recording.* Stimulus intensity is coded by rate of firing and firing-pattern regularity.
13. When our senses detect changes in energy, receptor cells fire vigorously to alert the brain. *Adaptation* is the temporary physiological response to a change in the environment; it varies according to the intensity of the change in the stimulus.

Vision 129

14. We can see because the receptors of our eyes receive and transduce the electromagnetic radiant energy of a very small portion of the electromagnetic sp
15. The bl
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16. The *len*
on the
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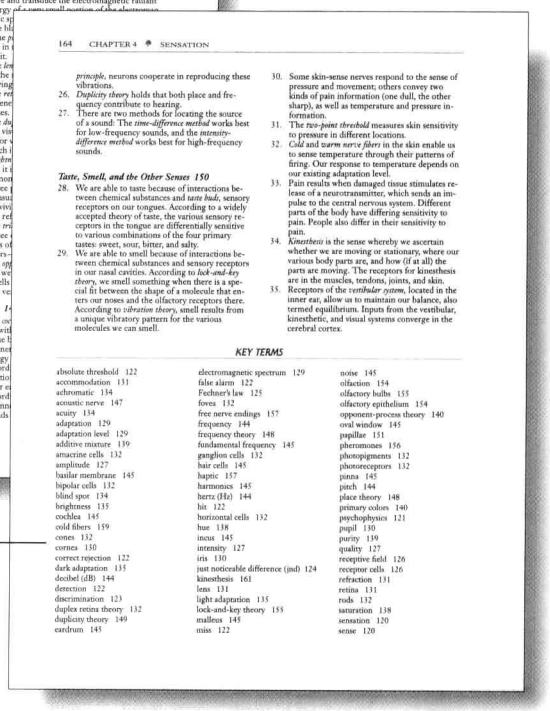

164 CHAPTER 4 SENSATION

principle, neurons cooperate in reproducing these vibrations.

26. *Duplicity theory* holds that both place and frequency contribute to hearing.
27. There are two methods for locating the source of a sound: The *time-difference method* works best for low-frequency sounds, and the *intensity-difference method* works best for high-frequency sounds.

Taste, Smell, and the Other Senses 150

28. We are able to taste because of interactions between chemical substances and *taste buds,* sensory receptors on our tongues. According to a widely accepted theory of taste, the various sensory receptors in the tongue are differentially sensitive to various combinations of the four primary tastes: sweet, sour, bitter, and salty.
29. We are able to smell because of interactions between chemical substances and sensory receptors in our nasal cavities. According to *lock-and-key theory,* we smell something when there is a special fit between the shape of a molecule that enters our noses and the olfactory receptors there. According to *vibration theory,* smell results from a unique vibratory pattern for the various molecules we can smell.
30. Some skin-sense nerves respond to the sense of pressure and movement; others convey two kinds of pain information (one dull, the other sharp), as well as temperature and pressure information.
31. The *two-point threshold* measures skin sensitivity to pressure in different locations.
32. *Cold* and *warm nerve fibers* in the skin enable us to sense temperature through their patterns of firing. Our response to temperature depends on our existing adaptation level.
33. Pain results when damaged tissue stimulates release of a neurotransmitter, which sends an impulse to the central nervous system. Different parts of the body have differing sensitivity to pain. People also differ in their sensitivity to pain.
34. *Kinesthesis* is the sense whereby we ascertain whether we are moving or stationary, where our various body parts are, and how (if at all) the parts are moving. The receptors for kinesthesis are in the muscles, tendons, joints, and skin.
35. Receptors of the *vestibular system,* located in the inner ear, allow us to maintain our balance, also termed equilibrium. Inputs from the vestibular, kinesthetic, and visual systems converge in the cerebral cortex.

KEY TERMS

absolute threshold 122
accommodation 131
achromatic 134
acoustic nerve 147
acuity 134
adaptation 129
adaptation level 129
additive mixture 139
amacrine cells 132
amplitude 127
basilar membrane 145
bipolar cells 132
blind spot 134
brightness 135
cochlea 145
cold fibers 159
cones 132
cornea 130
correct rejection 122
dark adaptation 135
decibel (dB) 144
detection 122
discrimination 123
duplex retina theory 132
duplicity theory 149
eardrum 145
electromagnetic spectrum 129
false alarm 122
Fechner's law 125
fovea 132
free nerve endings 157
frequency 144
frequency theory 148
fundamental frequency 145
ganglion cells 132
hair cells 145
haptic 157
harmonics 145
hertz (Hz) 144
hit 122
horizontal cells 132
hue 138
incus 145
intensity 127
iris 130
just noticeable difference (jnd) 124
kinesthesis 161
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lock-and-key theory 155
malleus 145
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noise 145
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olfactory bulbs 155
olfactory epithelium 154
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oval window 145
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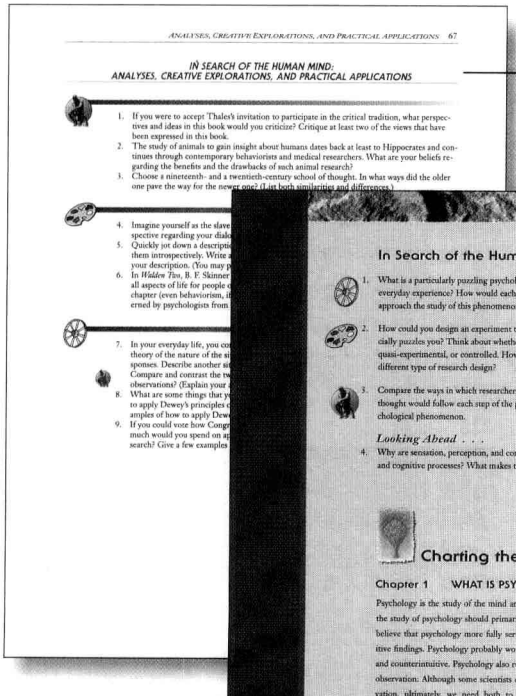
pheromones 156
photopigments 132
photoreceptors 132
pinna 145
pitch 144
place theory 148
primary colors 140
psychophysics 121
pupil 130
purity 139
quality 127
receptive field 126
receptor cells 126
refraction 131
retina 131
rods 132
saturation 138
sensation 120
sense 120

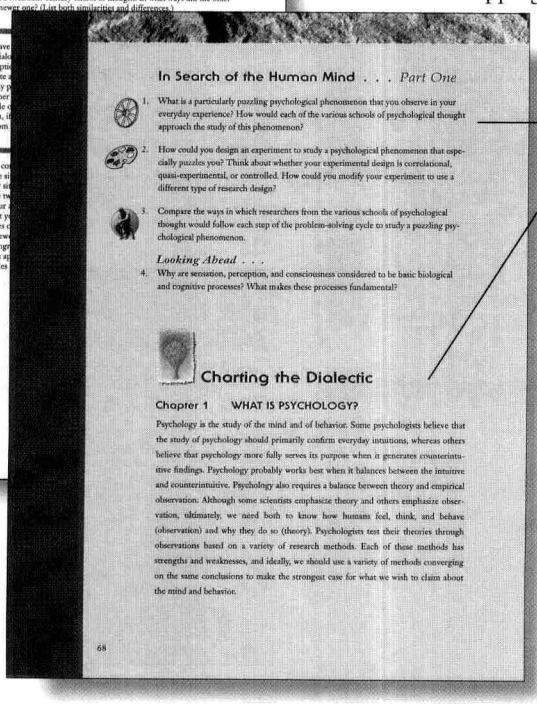
Key terms, identified in boldface and defined in the text, are listed at the end of the chapter with a page number referring you to where the term appears in the chapter. These terms and more are defined further in the glossary at the back of the book.



ANALYSES, CREATIVE EXPLORATIONS, AND PRACTICAL APPLICATIONS 67

IN SEARCH OF THE HUMAN MIND: ANALYSES, CREATIVE EXPLORATIONS, AND PRACTICAL APPLICATIONS

1. If you were to accept Thales's invitation to participate in the critical tradition, what perspectives and ideas in this book would you criticize? Critique at least two of the views that have been expressed in this book.
2. The study of animals to gain insight about humans dates back at least to Hippocrates and continues through contemporary behaviorists and medical researchers. What are your beliefs regarding the benefits and the drawbacks of such animal research?
3. Choose a nineteenth- and a twentieth-century school of thought. In what ways did the older one pave the way for the newer ones? (List both similarities and differences.)
4. Imagine yourself as the slave
spective regarding your dialo
5. Quickly jot down a descripti
them introspectively. Write
your description. (You may p
6. In *Walden Two,* B. F. Skinner
all aspects of life for people
chapter (even behaviorism, it
erned by psychologists from
7. In your everyday life, you co
theory of the nature of the s
sponses. Describe another s
Compare and contrast the t
observations? (Explain your
8. What are some things that y
to apply Dewey's principles
amples of how to apply Dew
9. If you could vote how Congr
much would you spend on a
search? Give a few examples



In Search of the Human Mind . . . *Part One*

1. What is a particularly puzzling psychological phenomenon that you observe in your everyday experience? How would each of the various schools of psychological thought approach the study of this phenomenon?
2. How could you design an experiment to study a psychological phenomenon that especially puzzles you? Think about whether your experimental design is correlational, quasi-experimental, or controlled. How could you modify your experiment to use a different type of research design?
3. Compare the ways in which researchers from the various schools of psychological thought would follow each step of the problem-solving cycle to study a puzzling psychological phenomenon.

Looking Ahead . . .

4. Why are sensation, perception, and consciousness considered to be basic biological and cognitive processes? What makes these processes fundamental?

Charting the Dialectic

Chapter 1 WHAT IS PSYCHOLOGY?

Psychology is the study of the mind and of behavior. Some psychologists believe that the study of psychology should primarily confirm everyday intuitions, whereas others believe that psychology more fully serves its purpose when it generates counterintuitive findings. Psychology probably works best when it balances between the intuitive and counterintuitive. Psychology also requires a balance between theory and empirical observation. Although some scientists emphasize theory and others emphasize observation, ultimately, we need both to know how humans feel, think, and behave (observation) and why they do so (theory). Psychologists test their theories through observations based on a variety of research methods. Each of these methods has strengths and weaknesses, and ideally, we should use a variety of methods converging on the same conclusions to make the strongest case for what we wish to claim about the mind and behavior.

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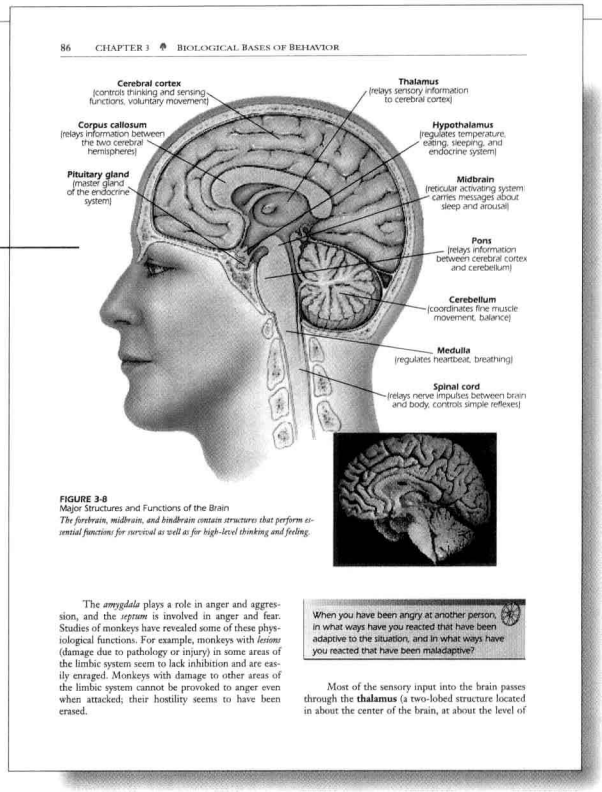
At the end of each chapter also are some broader **triarchic questions** that will help you summarize the concepts of the chapter and understand them in a larger context. You will find three questions of each triarchic type, with some of the questions at times overlapping as to the type of questions they are.

When you reach the end of the part, you will find ***In Search of . . .*** questions and **Charting the Dialectic** summaries for each chapter. They will help you draw together the concepts you just have studied, whether in the individual chapters, in many of the preceding chapters, or in the part as a whole. The *In Search of . . .* section also includes a *Looking Ahead . . .* question to upcoming chapters, to help you build upon your current knowledge and prepare for the chapters to come. The "Charting the Dialectic" paragraphs synopsize the evolution of theories and ideas in each chapter—reviewing the original theory (the *thesis*), then the opposing theory (the *antithesis*), and finally the integrated theory (the *synthesis).* The Dialectical Tree on the back endpapers helps you map the progression of the major theories.

Illustrations

Seeing both a detailed anatomical illustration and a photograph of part of that anatomy gives you a deeper understanding of the **physiological functions.**



86 CHAPTER 3 ♣ BIOLOGICAL BASES OF BEHAVIOR

FIGURE 3-8
Major Structures and Functions of the Brain
The forebrain, midbrain, and hindbrain contain structures that perform essential functions for survival as well as for high-level thinking and feeling.

The *amygdala* plays a role in anger and aggression, and the *septum* is involved in anger and fear. Studies of monkeys have revealed some of these physiological functions. For example, monkeys with *lesions* (damage due to pathology or injury) in some areas of the limbic system seem to lack inhibition and are easily enraged. Monkeys with damage to other areas of the limbic system cannot be provoked to anger even when attacked; their hostility seems to have been erased.

When you have been angry at another person, in what ways have you reacted that have been adaptive to the situation, and in what ways have you reacted that have been maladaptive?

Most of the sensory input into the brain passes through the **thalamus** (a two-lobed structure located in about the center of the brain, at about the level of

88 CHAPTER 3 ♣ BIOLOGICAL BASES OF BEHAVIOR

TABLE 3-2
Four Major Nuclei of the Thalamus*
Four key thalamic nuclei relay visual, auditory, somatosensory, and equilibrium-related information.

Name of Nucleus†	Receives Information from	Projects (Transmits Information) Primarily to	Functional Benefit
Lateral geniculate nucleus	The visual receptors, via optic nerves	The visual cortex	Permits us to see
Medial geniculate nucleus	The auditory receptors, via auditory nerves	The auditory cortex	Permits us to hear
Ventroposterior nucleus	The somatic nervous system	The primary somatosensory cortex	Permits us to sense pressure and pain
Ventrolateral nucleus	The cerebellum (in the hindbrain)	The primary motor cortex	Permits us to sense physical balance and equilibrium

*Other thalamic nuclei also play important roles.
†The names refer to the relative location of the nuclei within the thalamus: *lateral* = toward the right or left side of the medial nucleus; *ventral* = closer to the belly than to the top of the head; *posterior* = toward the back, behind; *ventroposterior* = bellyward and in the back; *ventrolateral* = bellyward and on the side

fighting, feeding, fleeing, and mating. It makes sense, therefore, that the hypothalamus is also active in regulating emotions and reactions to stress. Mild electrical stimulation in particular areas of the hypothalamus causes pleasurable sensations, whereas stimulation in nearby areas causes sensations of pain. The hypothalamus also plays an important role in the endocrine (hormonal) system (discussed later in this chapter).

The Midbrain

The midbrain is more important in nonmammals than in mammals, because in nonmammals it is the main source of control for visual and auditory information. In mammals these functions are mostly taken over by the forebrain, but the midbrain does help to control eye movements and coordination. Table 3-1 lists several structures and functions of the midbrain, but by far the most indispensable of these is the **reticular activating system,** a network of neurons essential to the regulation of consciousness (sleep, wakefulness, arousal, and even attention, to some extent) as well as to such vital functions as heart rate and breathing.

The reticular activating system (RAS) actually extends into the hindbrain. Both the reticular activating system and the thalamus are essential to our having any conscious awareness of or control over our existence. Together, the thalamus and hypothalamus, the midbrain, and the hindbrain form the **brain stem,** which connects the brain to the spinal cord. As you may already know or presume, physicians make a determination of brain death based on the function of the brain stem.

The Hindbrain

The hindbrain comprises the medulla oblongata, the pons, and the cerebellum. The **medulla oblongata**

Tables provide a simple comparison of sometimes detailed or complex information.

724 CHAPTER 20 ♣ HEALTH PSYCHOLOGY

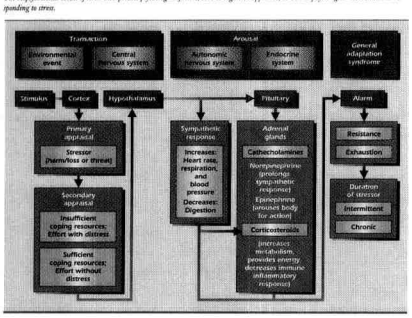
Think about your own pet peeves or the situations you love to hate. What things might literally make you sick? Now think about who might consider these peevish situations pleasant. What is it in your personality that makes some situations sickeningly stressful and others quite tolerable?

Susan Folkman and Richard Lazarus (Folkman & Lazarus, 1988; Folkman, Lazarus, Gruen, & DeLongis, 1986) have proposed a model for the way personality factors, stressful circumstances, and health interact. According to Folkman and Lazarus, when confronted with a potentially stressful situation, we first go through a two-step appraisal process and then a two-dimensional coping process, both of which interact with our distinctive personalities and the situation at hand (see Figure 20-3). In **primary appraisal,** we analyze just how much of a stake we have in the outcome of handling the particular situation. If we have no stake in the outcome, the entire process stops right there.

For example, suppose that I were to tell you of an alarming situation at your college: Some professors have been observed wearing dirty socks! You cannot let this situation continue! Right this instant, you must write a letter to the faculty senate of your college, urging the senate to pass a policy insisting that professors wear clean socks at all times! You must get the letter into the mail immediately!

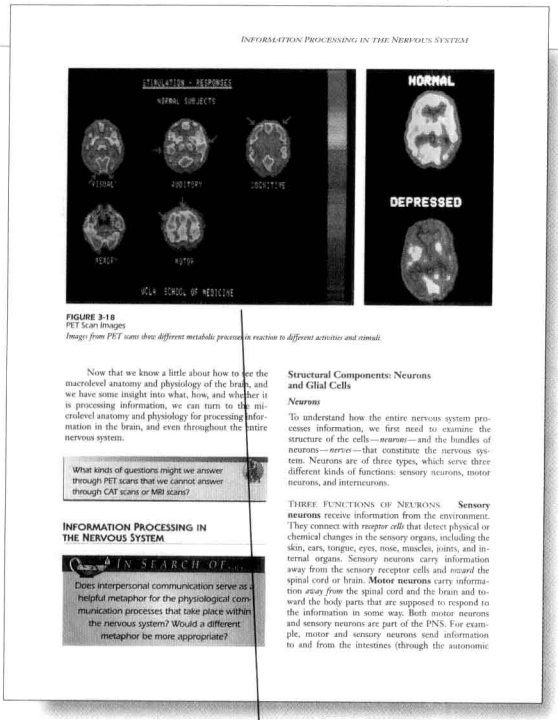
Did you feel your stress level go up? Probably not. You probably have very little stake in persuading professors to wear clean socks. You may even decide to ignore my urgent plea altogether. Now, compare that level of stress with the level of stress you feel when you think about the final examinations in all of your courses. Unless you are an extraordinarily re-

FIGURE 20-3
An Integrated Model of Stress
The biopsychosocial model of stress incorporates psychological factors, such as cognitive appraisal, as well as physiological mechanisms in responding to stress.



Charts visually simplify and clarify the more complex functions discussed in the text.

Photos



INFORMATION PROCESSING IN THE NERVOUS SYSTEM

FIGURE 3-10
PET Scan Images
Images from PET scans show different metabolic processes in reaction to different activities and stimuli.

Now that we know a little about how to see the macrolevel anatomy and physiology of the brain, and we have some insight into what, how, and whether it is processing information, we can turn to the microlevel anatomy and physiology for processing information in the brain, and even throughout the entire nervous system.

What kinds of questions might we answer through PET scans that we cannot answer through CAT scans or MRI scans?

INFORMATION PROCESSING IN THE NERVOUS SYSTEM

IN SEARCH OF...

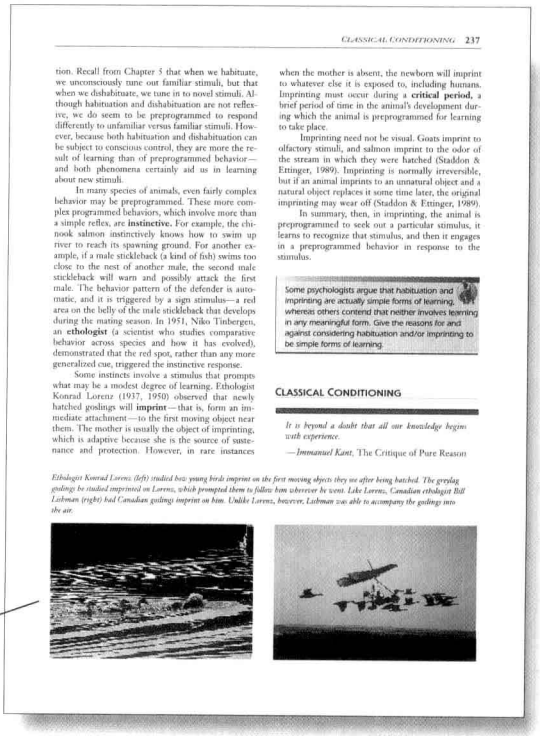
Does interpersonal communication serve as a helpful metaphor for the physiological communication processes that take place within the nervous system? Would a different metaphor be more appropriate?

Structural Components: Neurons and Glial Cells

Neurons

To understand how the entire nervous system processes information, we first need to examine the structure of the cells—*neurons*—and the bundles of neurons—*nerves*—that constitute the nervous system. Neurons are of three types, which serve three different kinds of functions: sensory neurons, motor neurons, and interneurons.

THREE FUNCTIONS OF NEURONS. **Sensory neurons** receive information from the environment. They connect with *receptor cells* that detect physical or chemical changes in the sensory organs, including the skin, ears, tongue, eyes, nose, muscles, joints, and internal organs. Sensory neurons carry information away from the sensory receptor cells and *toward* the spinal cord or brain. **Motor neurons** carry information *away from* the spinal cord and the brain and toward the body parts that are supposed to respond to the information in some way. Both motor neurons and sensory neurons are part of the PNS. For example, motor and sensory neurons send information to and from the intestines (through the autonomic



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tion. Recall from Chapter 5 that when we habituate, we unconsciously tune out familiar stimuli, but that when we dishabituate, we tune in to novel stimuli. Although habituation and dishabituation are not reflexive, we do seem to be preprogrammed to respond differently to unfamiliar versus familiar stimuli. However, because both habituation and dishabituation can be subject to conscious control, they are more the result of learning than of preprogrammed behavior—and both phenomena certainly aid us in learning about new stimuli.

In many species of animals, even fairly complex behavior may be preprogrammed. These more complex programmed behaviors, which involve more than a simple reflex, are **instinctive.** For example, the chinook salmon instinctively knows how to swim up river to reach its spawning ground. For another example, if a male stickleback (a kind of fish) swims too close to the nest of another male, the second male stickleback will warn and possibly attack the first male. The behavior pattern of the defender is automatic, and it is triggered by a sign stimulus—a red area on the belly of the male stickleback that develops during the mating season. In 1951, Niko Tinbergen, an **ethologist** (a scientist who studies comparative behavior across species and how it has evolved), demonstrated that the red spot, rather than any more generalized cue, triggered the instinctive response.

Some instincts involve a stimulus that prompts what may be a modest degree of learning. Ethologist Konrad Lorenz (1937, 1950) observed that newly hatched goslings will **imprint**—that is, form an immediate attachment—to the first moving object near them. The mother is usually the object of imprinting, which is adaptive because she is the source of sustenance and protection. However, in rare instances when the mother is absent, the newborn will imprint to whatever else it is exposed to, including humans. Imprinting must occur during a **critical period,** a brief period of time in the animal's development during which the animal is preprogrammed for learning to take place.

Imprinting need not be visual. Goats imprint to olfactory stimuli, and salmon imprint to the odor of the stream in which they were hatched (Staddon & Ettinger, 1989). Imprinting is normally irreversible, but if an animal imprints to an unnatural object and a natural object replaces it some time later, the original imprinting may wear off (Staddon & Ettinger, 1989).

In summary, then, in imprinting, the animal is preprogrammed to seek out a particular stimulus, it learns to recognize that stimulus, and then it engages in a preprogrammed behavior in response to the stimulus.

Some psychologists argue that habituation and imprinting are actually simple forms of learning, whereas others contend that neither involves learning in any meaningful form. Give the reasons for and against considering habituation and/or imprinting to be simple forms of learning.

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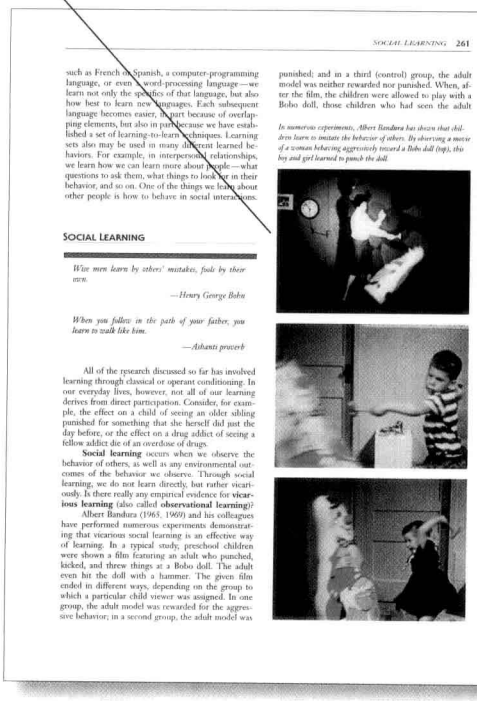
It is beyond a doubt that all our knowledge begins with experience.

—Immanuel Kant, The Critique of Pure Reason

Ethologists Konrad Lorenz (left) studied how young birds imprint on the first moving objects they see after being hatched. The greylag goslings he studied imprinted on Lorenz, which prompted them to follow him wherever he went. Like Lorenz, Canadian ethologist Bill Lishman (right) had Canadian goslings imprint on him. Unlike Lorenz, however, Lishman was able to accompany the goslings into the air.



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such as French or Spanish, a computer-programming language, or even a word-processing language—we learn not only the specifics of that language, but also how best to learn new languages. Each subsequent language becomes easier, in part because of overlapping elements, but also in part because we have established a set of learning-to-learn techniques. Learning sets also may be used in many different learned behaviors. For example, in interpersonal relationships, we learn how we can learn more about people—what questions to ask them, what things to look for in their behavior, and so on. One of the things we learn about other people is how to behave in social interactions.

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Wise men learn by others' mistakes, fools by their own.

—Henry George Bohn

When you follow in the path of your father, you learn to walk like him.

—Ashanti proverb

All of the research discussed so far has involved learning through classical or operant conditioning. In our everyday lives, however, not all of our learning derives from direct participation. Consider, for example, the effect on a child of seeing an older sibling punished for something that she herself did just the day before, or the effect on a drug addict of seeing a fellow addict die of an overdose of drugs.

Social learning occurs when we observe the behavior of others, as well as any environmental outcomes of the behavior we observe. Through social learning, we do not learn directly, but rather vicariously. Is there really any empirical evidence for **vicarious learning** (also called **observational learning**)?

Albert Bandura (1965, 1969) and his colleagues have performed numerous experiments demonstrating that vicarious social learning is an effective way of learning. In a typical study, preschool children were shown a film featuring an adult who punched, kicked, and threw things at a Bobo doll. The adult even hit the doll with a hammer. The given film ended in different ways, depending on the group to which a particular child viewer was assigned. In one group, the adult model was rewarded for the aggressive behavior; in a second group, the adult model was punished; and in a third (control) group, the adult model was neither rewarded nor punished. When, after the film, the children were allowed to play with a Bobo doll, those children who had seen the adult

In numerous experiments, Albert Bandura has shown that children learn to imitate the behavior of others. By observing a movie of a woman behaving aggressively toward a Bobo doll (top), this boy and girl learned to punch the doll.

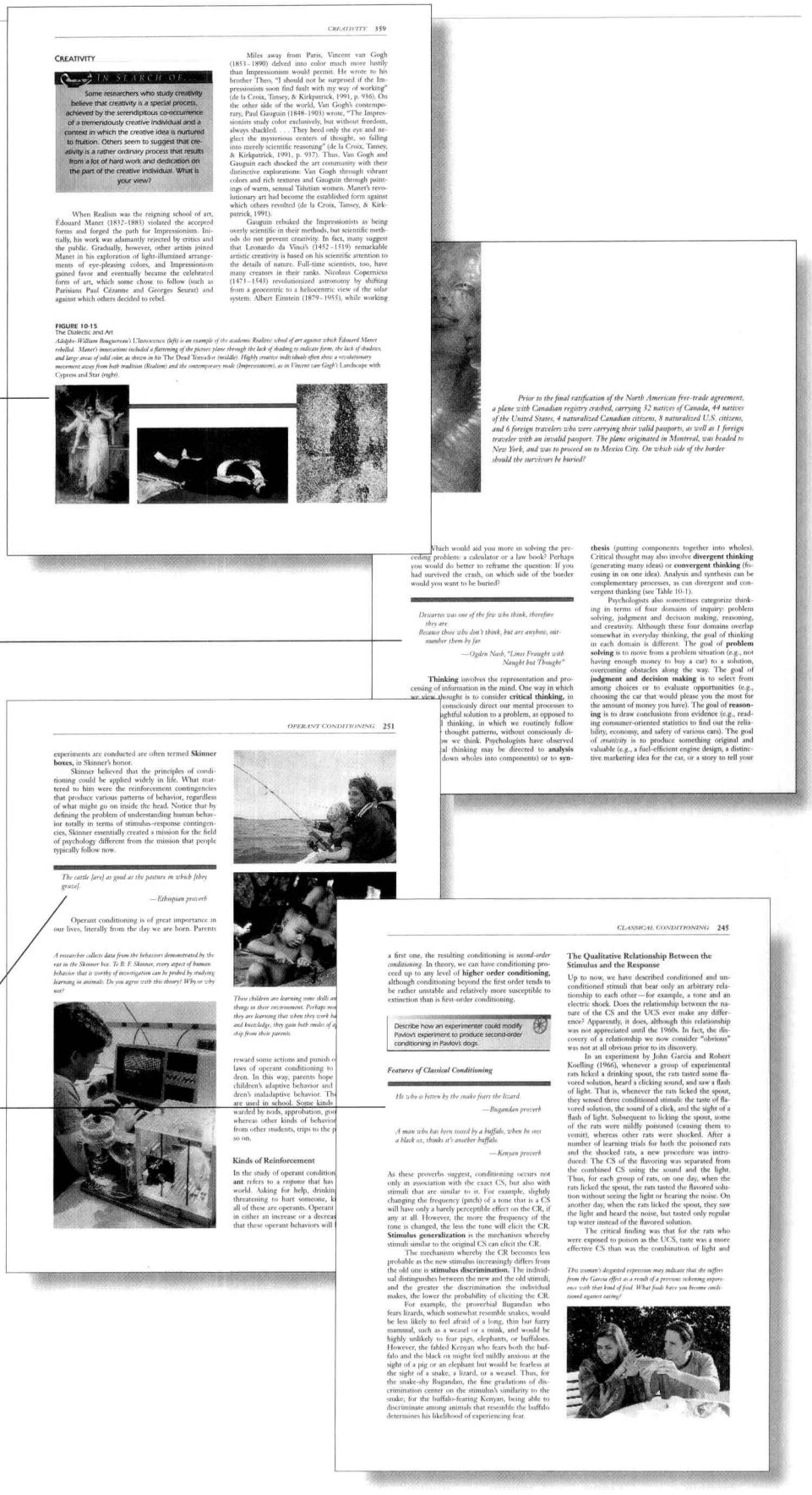
Photographs showing psychological research and applications illustrate, for example, how biological functions affect behavior, how people can learn by observing, and how psychological principles and theories can explain behavior such as these children imitating the actions of an adult.

Relating to the World

Examples of **art** demonstrate psychological concepts and themes. Here, the dialectical progression is recorded in paintings that reveal a shift in thinking over time.

The poetry of Ogden Nash is one example of a reference to **literature.** These references not only relate to the text's discussion but also incorporate learning from other disciplines.

Although the formal study of psychology is a Western tradition, many of the theories of psychology can be applied to peoples all over the world. Similarly, much of the wisdom of other cultures applies equally to Western culture. This book provides **cultural examples** in the text, in the illustrations, and in the quotations interspersed in the chapters.



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CREATIVITY

IN SEARCH OF...

Some researchers who study creativity believe that creativity is a special process, achieved by the serendipitous co-occurrence of a tremendously creative individual and a context in which the creative idea is nurtured to fruition. Others seem to suggest that creativity is a rather ordinary process that results from a lot of hard work and dedication on the part of the creative individual. What is your view?

When Realism was the reigning school of art, Édouard Manet (1832–1883) violated the accepted forms and forged the path for Impressionism. Initially, his work was adamantly rejected by critics and the public. Gradually, however, other artists joined Manet in his exploration of light-illumined arrangements of eye-pleasing colors, and Impressionism gained favor and eventually became the celebrated form of art, which some chose to follow (such as Parisians Paul Cézanne and Georges Seurat) and against which others decided to rebel.

Miles away from Paris, Vincent van Gogh (1853–1890) delved into color much more lustily than Impressionism would permit. He wrote to his brother Theo, "I should not be surprised if the Impressionists soon find fault with my way of working" (de la Croix, Tansey, & Kirkpatrick, 1991, p. 936). On the other side of the world, Van Gogh's contemporary, Paul Gauguin (1848–1903) wrote, "The Impressionists study color exclusively, but without freedom, always shackled. . . . They heed only the eye and neglect the mysterious centers of thought, so falling into merely scientific reasoning" (de la Croix, Tansey, & Kirkpatrick, 1991, p. 937). Thus, Van Gogh and Gauguin each shocked the art community with their distinctive explorations: Van Gogh through vibrant colors and rich textures and Gauguin through paintings of warm, sensual Tahitian women. Manet's revolutionary art had become the established form against which others revolted (de la Croix, Tansey, & Kirkpatrick, 1991).

Gauguin rebuked the Impressionists as being overly scientific in their methods, but scientific methods do not prevent creativity. In fact, many suggest that Leonardo da Vinci's (1452–1519) remarkable artistic creativity is based on his scientific attention to the details of nature. Full-time scientists, too, have many creators in their ranks. Nicolaus Copernicus (1473–1543) revolutionized astronomy by shifting from a geocentric to a heliocentric view of the solar system. Albert Einstein (1879–1955), while working

FIGURE 10-15
The Dialectic and Art
Adolphe-William Bouguereau's L'Innocence *(left) is an example of the academic Realistic school of art against which Édouard Manet rebelled. Manet's innovations included a flattening of the picture plane through the lack of shading to indicate form, the lack of shadows, and large areas of solid color, as shown in his* The Dead Toreador *(middle). Highly creative individuals often show a revolutionary movement away from built tradition (Realism) and the contemporary mode (Impressionism), as in Vincent van Gogh's* Landscape with Cypress and Star *(right).*

Prior to the final ratification of the North American free-trade agreement, a plane with Canadian registry crashed, carrying 32 natives of Canada, 44 natives of the United States, 4 naturalized Canadian citizens, 8 naturalized U.S. citizens, and 6 foreign travelers who were carrying their valid passports, as well as 1 foreign traveler with an invalid passport. The plane originated in Montreal, was headed to New York, and was to proceed on to Mexico City. On which side of the border should the survivors be buried?

Which would aid you more in solving the preceding problem: a calculator or a law book? Perhaps you would do better to reframe the question: If you had survived the crash, on which side of the border would you want to be buried?

Descartes was one of the few who think, therefore they are.
Because those who don't think, but are anyhow, outnumber them by far.
—Ogden Nash, "Lines Fraught with Naught but Thought"

Thinking involves the representation and processing of information in the mind. One way in which we view thought is to consider **critical thinking,** in which we consciously direct our mental processes to arrive at a rightful solution to a problem, as opposed to [illegible] thinking, in which we routinely follow [illegible] thought patterns, without consciously directing how we think. Psychologists have observed that critical thinking may be directed to **analysis** (breaking down wholes into components) or to **synthesis** (putting components together into wholes). Critical thought may also involve **divergent thinking** (generating many ideas) or **convergent thinking** (focusing in on one idea). Analysis and synthesis can be complementary processes, as can divergent and convergent thinking (see Table 10-1).

Psychologists also sometimes categorize thinking in terms of four domains of inquiry: problem solving, judgment and decision making, reasoning, and creativity. Although these four domains overlap somewhat in everyday thinking, the goal of thinking in each domain is different. The goal of **problem solving** is to move from a problem situation (e.g., not having enough money to buy a car) to a solution, overcoming obstacles along the way. The goal of **judgment and decision making** is to select from among choices or to evaluate opportunities (e.g., choosing the car that would please you the most for the amount of money you have). The goal of **reasoning** is to draw conclusions from evidence (e.g., reading consumer-oriented statistics to find out the reliability, economy, and safety of various cars). The goal of *creativity* is to produce something original and valuable (e.g., a fuel-efficient engine design, a distinctive marketing idea for the car, or a story to tell your

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experiments are conducted are often termed **Skinner boxes,** in Skinner's honor.

Skinner believed that the principles of conditioning could be applied widely in life. What mattered to him were the reinforcement contingencies that produce various patterns of behavior, regardless of what might go on inside the head. Notice that by defining the problem of understanding human behavior totally in terms of stimulus–response contingencies, Skinner essentially created a mission for the field of psychology different from the mission that people typically follow now.

The cattle [are] as good as the pasture in which [they] graze[].
—Ethiopian proverb

Operant conditioning is of great importance in our lives, literally from the day we are born. Parents

A researcher collects data from the behaviors demonstrated by the rat in the Skinner box. To B. F. Skinner, every aspect of human behavior that is worthy of investigation can be probed by studying learning in animals. Do you agree with this theory? Why or why not?

These children are learning some skills an[illegible] things in their environment. Perhaps mos[illegible] they are learning that when they work ha[illegible] and knowledge, they gain both modes of a[illegible] ship from their parents.

reward some actions and punish o[illegible] laws of operant conditioning to [illegible] dren. In this way, parents hope [illegible] children's adaptive behavior and [illegible] dren's maladaptive behavior. Th[illegible] are used in school. Some kinds [illegible] warded by nods, approbation, goo[illegible] whereas other kinds of behavio[illegible] from other students, trips to the p[illegible] so on.

Kinds of Reinforcement

In the study of operant condition[illegible] ant refers to a *response* that has [illegible] world. Asking for help, drinkin[illegible] threatening to hurt someone, k[illegible] all of these are operants. Operant [illegible] in either an increase or a decrea[illegible] that these operant behaviors will [illegible]

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a first one, the resulting conditioning is *second-order conditioning.* In theory, we can have conditioning proceed up to any level of **higher order conditioning,** although conditioning beyond the first order tends to be rather unstable and relatively more susceptible to extinction than is first-order conditioning.

Describe how an experimenter could modify Pavlov's experiment to produce second-order conditioning in Pavlov's dogs.

Features of Classical Conditioning

He who is bitten by the snake fears the lizard.
—Bugandan proverb

A man who has been tossed by a buffalo, when he sees a black ox, thinks it's another buffalo.
—Kenyan proverb

As these proverbs suggest, conditioning occurs not only in association with the exact CS, but also with stimuli that are similar to it. For example, slightly changing the frequency (pitch) of a tone that is a CS will have only a barely perceptible effect on the CR, if any at all. However, the more the frequency of the tone is changed, the less the tone will elicit the CR. **Stimulus generalization** is the mechanism whereby stimuli similar to the original CS can elicit the CR.

The mechanism whereby the CR becomes less probable as the new stimulus increasingly differs from the old one is **stimulus discrimination.** The individual distinguishes between the new and the old stimuli, and the greater the discrimination the individual makes, the lower the probability of eliciting the CR.

For example, the proverbial Bugandan who fears lizards, which somewhat resemble snakes, would be less likely to feel afraid of a long, thin but furry mammal, such as a weasel or a mink, and would be highly unlikely to fear pigs, elephants, or buffaloes. However, the fabled Kenyan who fears both the buffalo and the black ox might feel mildly anxious at the sight of a pig or an elephant but would be fearless at the sight of a snake, a lizard, or a weasel. Thus, for the snake-shy Bugandan, the fine gradations of discrimination center on the stimulus's similarity to the snake; for the buffalo-fearing Kenyan, being able to discriminate among animals that resemble the buffalo determines his likelihood of experiencing fear.

The Qualitative Relationship Between the Stimulus and the Response

Up to now, we have described conditioned and unconditioned stimuli that bear only an arbitrary relationship to each other—for example, a tone and an electric shock. Does the relationship between the nature of the CS and the UCS ever make any difference? Apparently, it does, although this relationship was not appreciated until the 1960s. In fact, the discovery of a relationship we now consider "obvious" was not at all obvious prior to its discovery.

In an experiment by John Garcia and Robert Koelling (1966), whenever a group of experimental rats licked a drinking spout, the rats tasted some flavored solution, heard a clicking sound, and saw a flash of light. That is, whenever the rats licked the spout, they sensed three conditioned stimuli: the taste of flavored solution, the sound of a click, and the sight of a flash of light. Subsequent to licking the spout, some of the rats were mildly poisoned (causing them to vomit), whereas other rats were shocked. After a number of learning trials for both the poisoned rats and the shocked rats, a new procedure was introduced: The CS of the flavoring was separated from the combined CS using the sound and the light. Thus, for each group of rats, on one day, when the rats licked the spout, the rats tasted the flavored solution without seeing the light or hearing the noise. On another day, when the rats licked the spout, they saw the light and heard the noise, but tasted only regular tap water instead of the flavored solution.

The critical finding was that for the rats who were exposed to poison as the UCS, taste was a more effective CS than was the combination of light and

This woman's disgusted expression may indicate that she suffers from the Garcia effect as a result of a previous sickening experience with that kind of food. What foods have you become conditioned against eating?