JEANNE ORMROD

HUMAN LEARNING

SEVENTH EDITION

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HUMAN LEARNING

SEVENTH EDITION

Jeanne Ellis Ormrod
University of Northern Colorado (Emerita)

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To Olivia, Miles, and Jack,
the next generation of learners

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Preface

I always enjoy writing and updating *Human Learning*. Each passing year brings exciting new research findings about how human beings think and learn. As a result, each year also brings new strategies for helping learners of all ages acquire information and skills—as well as beliefs, motives, and attitudes—that will be useful and productive both inside and outside the classroom. As you explore the nature of human learning in the pages ahead, I hope that my fascination with the topic will be contagious.

I've written this book with particular readers in mind: those who would like to learn about learning but don't necessarily have much background in psychology. Such readers may benefit from studying the historical roots of learning theories but prefer to focus their energies on studying contemporary perspectives and ideas. These readers might find learning theories fascinating but lose patience when they can't see much relevance of the theories to everyday practice. They don't want to be overwhelmed by the many nit-picky sources of disagreement among theorists who, for the most part, are explaining human learning and thinking processes in very similar ways. And they're quite capable of reading a dry, terse textbook but probably learn more effectively from a book that shows how different concepts relate to one another; provides numerous examples; and, especially, emphasizes meaningful learning—true *understanding*—of the material it presents.

New to This Edition

Users of the sixth edition will see a great many changes in this seventh edition. As I always do, I've updated the text in innumerable spots to reflect current theoretical perspectives and research findings regarding cognition, learning, and instructional practices. I've also increased coverage of technology-based interventions in several chapters. And I've worked hard to tighten my prose, eliminating needless redundancies and clarifying spots that struck me as awkward or ambiguously worded.

A more noticeable change is a reduction of the sixth edition's 17 chapters into 15 chapters. The three previous behaviorism chapters are now only two, "Behaviorist Principles and Theories" (Chapter 3) and "Applications of Behaviorist Principles" (Chapter 4), with considerable

reorganization of topics. In addition, the two previous chapters on long-term memory storage and retrieval have been combined into a single chapter, "Long-Term Memory Storage and Retrieval Processes" (Chapter 8), with deletion of some ideas and examples that were probably "TMI"—too much information.

Furthermore, consistent with our ever-evolving understanding of human learning, I've added or expanded on a number of topics, and I've deleted a handful of topics that, again, were probably TMI. Following are notable examples:

- *Chapter 1:* New (brief) discussion of different types of learning research (per reviewer requests); updated discussion of how theories have evolved over time to incorporate other contextual views and neuroscience; expansion of Figure 1.2 to portray new theoretical orientations on the scene.
- *Chapter 2:* New discussion of adolescent risk taking in the section on brain development; new discussion of heredity/environment interactions in brain development; new bullet regarding the importance of sleep and exercise.
- *Chapter 3 (integration of parts of the former Chapters 3 and 4):* Discussion of classical conditioning in television commercials (per reviewer request); switch back to the term *operant conditioning* in the discussion of reinforcement, with the term *instrumental conditioning* being introduced in a subsequent section on punishment; deletion of sections on sensory preconditioning and Guthrie's (1935) strategies for breaking habits; explanation of what *reinforcement* means in classical conditioning (per reviewer request); token reinforcers added as a new bulleted item to the section on positive reinforcement.
- *Chapter 4 (formerly Chapter 5, with the addition of some content from the former Chapter 3):* Inclusion of Common Core in the section on instructional objectives; new section on assessment practices from a behaviorist perspective, with relevant discussions of high-stakes tests, backward design, and rubrics.
- *Chapter 5 (formerly Chapter 6):* Revision of "emotional state" to "physiological state" as a factor affecting self-efficacy, to represent more accurately Bandura's (1997) discussion of this factor; addition of effortful control as an individual difference variable in self-regulation; addition of self-videos as a strategy for self-monitoring; new bulleted section on teacher self-efficacy.
- *Chapter 6 (formerly Chapter 7):* Movement of general assumptions to beginning of chapter, to be parallel to the organization of Chapters 3 and 5; more explicit ties of cognitivist ideas to social cognitive theory.
- *Chapter 7 (formerly Chapter 8):* Expansion of the discussion of the central executive, with a subheading to enhance its visibility in the chapter; discussion of effortful control here as well as in Chapter 5; expanded discussion of long-term memory's permanence or non-permanence (moved from the old Chapter 11); introduction of the concept *cognitive load,* which has been alluded to but not specifically labeled in previous editions; enhanced discussion of how to help students direct their attention in beneficial ways, including the issue of choosing productive links in websites and instructional software; new bullet regarding the possible value of computer-based strategies for enhancing attention and working memory capacity (note my use of the word *possible,* because the jury's still out on the viability of such approaches).
- *Chapter 8 (formerly Chapters 9 and 11):* Content condensed, with some content being moved into Chapter 7; reorganization of content to minimize redundancies; critique of the literature on learning styles (in a footnote).

- *Chapter 9 (formerly Chapter 10):* Addition of a possible neurological explanation for the difficulty of undergoing significant conceptual change; new discussion of multiple-choice formative assessment tasks as a way of encouraging conceptual change.
- *Chapter 10 (formerly Chapter 12):* Addition of cognitive load as an issue in inquiry learning.
- *Chapter 11 (formerly Chapter 13):* New discussion of communities of practice; concept of legitimate peripheral participation (formerly in a footnote) brought into the body of the text; expanded discussion of other contextualist views, with headings and a new section and figure on Bronfenbrenner's ecological systems theory; new bullet regarding technology-based strategies for scaffolding performance and/or providing virtual realistic settings for skill development; expanded discussion of technology-based collaborative learning.
- *Chapter 12 (formerly Chapter 14):* New discussion of metacognitive skills and strategies important for hypertext and the Internet; expansion of what co-regulated learning might involve; reduced overlap with discussion of effective storage processes in what is now Chapter 8; deletion of the keyword mnemonic for remembering dates and other numbers (because very few people actually use it); expanded discussion of epistemic beliefs; inclusion of *Betty's Brain* as an example of technology-based metacognitive scaffolding.
- *Chapter 13 (formerly Chapter 15):* Addition of the concept *adaptive expertise* in the discussion of transfer and problem solving; expanded discussion of possible scaffolds for student problem solving, with a focus on technology-based supports (e.g., intelligent tutors); expanded discussion of authentic activities, including a new bullet on technology-based semi-authentic activities; new figure illustrating how a multiple-choice question might assess transfer; expanded discussion of critical thinking.
- *Chapter 14 (formerly Chapter 16):* Expanded discussion of situated motivation to emphasize person–environment interactions; heavier emphasis on the term *autonomy* (rather than on *self-determination*), in line with most contemporary writings about this topic; expansion of the section on the need for relatedness to include the need for belonging and the sixth edition's material on the need for affiliation; new section on one's sense of identity as an individual difference variable in motivation; addition of *adaptability* to the discussion of dispositions; new discussion of boredom as an affective state.
- *Chapter 15 (formerly Chapter 17):* Expanded discussion of interest to include sociocultural influences on its development; expansion of section on work-avoidance goals to include doing-just-enough goals; addition of *emotion regulation* as a key term in the section on self-regulation; new discussion of epistemic beliefs on student-identified goals in a learning activity.

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Jeanne Ellis Ormrod

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CHAPTER 1

PERSPECTIVES ON LEARNING

LEARNING OUTCOMES

1.1. Explain what learning is and various ways in which it might be manifested in a person's behavior.

1.2. Briefly describe several types of research that psychologists have conducted to investigate the nature of learning.

1.3. Distinguish between principles and theories of learning, and explain how both principles and theories can guide the development of effective instructional and therapeutic interventions.

1.4. Describe various theoretical perspectives of learning that have emerged and evolved since the early 1900s.

When my son Alex was in kindergarten, his teacher asked me *please* to do something about his shoes. I had been sending Alex to school each morning with his shoelaces carefully tied, yet by the time he arrived at his classroom door, the laces were untied and flopping every which way—a state to which they invariably returned within 10 minutes of his teacher's retying them. Although I had given Alex numerous shoe-tying lessons, the step-by-step procedure I had taught him never seemed to "stick." I then suggested that we double-knot the laces each morning, but Alex rejected this strategy as too babyish. As an alternative, I purchased a couple of pairs of shoes with Velcro straps instead of laces, but Alex gave the shoes such a workout that the Velcro quickly separated from the leather, and so we went back to laces. By March, his exasperated teacher was insisting that Alex learn how to tie his shoes. So I sat down with him and demonstrated, for the umpteenth time, how to put two laces together to make a presentable bow. This time, however, I accompanied my explanation with a magical statement: "Alex, when you learn to tie your shoes, I'll give you a quarter." His eyes lit up, and he had shoe-tying perfected in five minutes. After that, we didn't have a single complaint from school—well, at least not about his shoes.

When my daughter Tina was in fourth grade, she felt considerable frustration with a series of homework assignments in subtraction. She had never learned the basic subtraction facts, despite my continually nagging her to practice them, the result being that she couldn't solve many two- and three-digit subtraction problems. One night, after her typical half-hour tantrum about

"these stupid problems," my husband explained to Tina that subtraction was nothing more than reversed addition and that her knowledge of addition facts could help her with subtraction. Something must have clicked in Tina's head, because we weren't subjected to any more tantrums about subtraction. Multiplication and division continued to be problematic for her—and don't get me started about the fractions that came later—but at least she had unraveled the mystery of subtraction.

Human learning takes many forms. Some instances of learning are readily observable, such as when a child learns to tie shoes. Other instances may lie below the surface, such as when a child gains a better understanding of mathematical principles. And people learn for a variety of reasons. Some learn for the external rewards their achievements bring—for example, for good grades, recognition, or money. But others learn for less obvious, more internal reasons—perhaps to gain a sense of accomplishment and satisfaction, or perhaps simply to make their lives easier.

The Importance of Learning

Many species have things easy compared to human beings, or at least so it would seem. Birds, for example, are born with a wealth of knowledge that we humans must learn. They seem to be biologically hardwired with home-building skills; we either have to be taught something about framing, roofing, and dry walling or must hire someone else to do these things for us. Birds know, without being taught, exactly when to fly south and how to get there; we have to look at calendars and road maps. Birds instinctively know how to care for their young; meanwhile, we attend prenatal classes, read child-care books, and watch other people demonstrate how to change diapers.

Yet we human beings—not birds—are the ones getting ahead in this world. We have learned to make increasingly sturdy and comfortable homes, developed increasingly expedient modes of transportation, and are feeding and caring for our offspring so well that each generation grows taller, stronger, and healthier than the preceding one. Birds, meanwhile, are living the same primitive lifestyles they've had for centuries.

The ability to acquire a large body of knowledge and a wide variety of behaviors allows the human race a greater degree of flexibility and adaptability than is true for any other species on the planet. Because so little of our behavior is instinctive and so much of it is learned, we're able to benefit from our experiences. We discover which actions are likely to lead to successful outcomes and which are not, and we modify our behaviors accordingly. And as we pass on to children the wisdom we've gained from our ancestors and from our own experiences, each generation becomes just that much more capable of behaving intelligently.

To be sure, many nonhuman species learn a great deal over the course of their lifetimes. Our family dog Tobey learned that his dinner was usually served around 4 o'clock and that having a leash attached to his collar meant that a walk was imminent. Our cat Geisha learned that her litter box was in the laundry room and that a loud hiss could effectively dissuade a human from picking her up when she wasn't in the mood for cuddling. When I planted blueberry bushes outside my office window one summer, the neighborhood birds quickly discovered that the bushes were an abundant source of food and that the aluminum pie plates I hung to scare them away weren't going to do them any harm.

The more I observe and read about nonhuman animals, the more I become convinced that we humans greatly underestimate their intelligence and ability to learn. As an example, look at

Figure 1.1
Fifteen-year-old Somjai's painting of an elephant.

the painting in Figure 1.1. I watched 15-year-old Somjai paint it when I visited the Maetaman Elephant Camp in Thailand in 2006. Somjai clearly knew how to paint an elephant. What was most remarkable about this fact was that Somjai *was* an elephant. In 2006, Somjai was painting only pictures very similar to the one I show you here, but when I returned to the camp in 2008, he had expanded his repertoire considerably and could also paint an elephant grabbing a tree branch or shooting a basketball into a basket (elephant basketball was big at the camp). And the asking price for Somjai's work had skyrocketed from 20 dollars (the price I paid in 2006) to 100 dollars. A few years later, Somjai's paintings (all of elephants) were selling online for 600 to 700 dollars.

But there seem to be limits to what nonhuman species can learn. For instance, only a very small percentage of elephants become skillful painters like Somjai, and they do so only after intensive training (you can find several videos of elephant painters on YouTube). Furthermore, their artistic repertoires seem to be largely restricted to elephants, flowers, trees, and perhaps a few simple background details (e.g., notice the mountains in Somjai's painting). Many elephants reportedly have little inclination for painting at all, and most of those that do paint can make only random strokes on the canvas.

In contrast to Somjai and his talented peers, most human beings can paint not only elephants and plants but an infinite number of other things as well, often without having had much training or guidance. Painting is, for humans, not simply executing a specific sequence of brush strokes. Instead, people seem to be guided by internal "somethings"—perhaps a mental image of an elephant or flower, and probably some general strategies for representing physical entities on paper—and they can adapt those somethings quite flexibly in their various artistic endeavors.

Thus, we human beings seem to inherit an ability to think and learn in ways that nonhumans cannot. The particular environment in which we live has a huge impact on the knowledge and skills we do and don't acquire, of course, but our capacity to be versatile and adapt to many *different* situations and environments far exceeds that of other animal species.

Defining Learning

Alex's learning to tie his shoes and Tina's learning the addition–subtraction relationship are both examples of human learning. Consider these additional examples:

- The mother of a 6-year-old boy insists that her son take on a few household chores, for which he earns a small weekly allowance. Whenever he saves his allowance for two or three weeks, he has enough money to buy an inexpensive toy of his own choosing. In the process of being regularly paid for his work and saving his earnings, the boy acquires an increasing appreciation for the value of money.
- A college student from a small town is, for the first time, exposed to political viewpoints quite different from her own. After engaging in heated debates with classmates, she reflects on and gradually modifies her own political views.
- A toddler is overly affectionate with a neighborhood dog, and the dog responds by biting the toddler's hand. After this incident, the child cries and runs quickly to his mother every time he sees a dog.

As you can see, learning is the means through which we acquire not only skills and knowledge, but also values, attitudes, and emotional reactions.

For purposes of our discussions in this book, we'll define **learning** as a long-term change in mental representations or associations as a result of experience. Let's divide this definition into its three parts. First, learning is a *long-term change:* It isn't just a brief, transitory use of information—such as remembering a phone number long enough to call someone and then forgetting it—but it doesn't necessarily last forever. Second, learning involves *mental representations or associations* and so presumably has its basis in the brain. Third, learning is a change *as a result of experience,* rather than the result of physiological maturation, fatigue, use of alcohol or drugs, or onset of mental illness or dementia.

Sometimes learning is a very passive process: It happens simply by virtue of something happening *to* a learner. More often, however, it requires the learner to *do* something—something physical, something mental, or, ideally, something *both* physical and mental.

Determining When Learning Has Occurred

Many psychologists would agree with the definition of learning I've just presented. However, some would prefer that the focus be on changes in *behavior* rather than on changes in mental representations or associations (more on this point shortly). In fact, regardless of how we define learning, we know it has occurred only when we actually see it reflected in a person's behavior. For example, we might see a learner:

- Performing a completely new behavior—perhaps tying shoes correctly for the first time
- Changing the frequency of an existing behavior—perhaps more regularly cooperating with (rather than acting aggressively toward) classmates

- Changing the speed of an existing behavior—perhaps recalling certain subtraction facts more quickly than before
- Changing the intensity of an existing behavior—perhaps throwing increasingly outrageous temper tantrums as a way of obtaining desired objects
- Changing the complexity of an existing behavior—perhaps discussing a particular topic in greater depth and detail after receiving instruction about the topic
- Responding differently to a particular stimulus—perhaps crying and withdrawing at the sight of a dog after having previously been eager to interact with dogs

Throughout the book, we'll continue to see these and other approaches to assessing learning. Furthermore, we'll discover that the ways in which people's learning is assessed can either directly or indirectly have a significant impact on their *future* learning.

Types of Learning Research

Although psychologists may differ in their views of how best to define learning and determine when it has occurred, virtually all of them agree on one point: They can best understand the nature of learning by studying it objectively and systematically through research. The systematic study of behavior, including human and animal learning processes, has emerged only within the past century or so, making psychology a relative newcomer to scientific inquiry. But in a century's time, countless research studies have investigated how people and many other species learn.

When studying the nature of human learning, some psychologists conduct **basic research**: They investigate specific learning processes under tightly controlled conditions, often looking at people's responses to contrived learning experiences in a laboratory. Others conduct **applied research**: They investigate people's learning in more "real-world" tasks and settings—for instance, by looking at how children learn certain science concepts in middle school classrooms. The kinds of data collected vary from study to study as well. In some instances the data collected are **quantitative**, taking the form of measurements and other numbers. In other cases the data are **qualitative**, in that they're complex verbal or behavioral performances that a researcher must closely inspect and then judge for the presence or absence of specific contents or skills. All of these forms of research and data—basic and applied, quantitative and qualitative—have contributed immensely to our understanding of human learning, and thus I will draw heavily from all of them throughout the book.

Learning Principles and Theories

Consistent patterns in research findings have led psychologists to make generalizations about learning processes through the formulation of both principles and theories of learning. **Principles** of learning identify certain factors that influence learning and describe the specific effects these factors have. For example, consider this principle:

> A behavior that is followed by a satisfying state of affairs—a reward—is more likely to increase in frequency than a behavior not followed by a reward.

In this principle, a particular factor (a rewarding consequence) is identified as having a particular effect (an increase in the behavior's frequency). The principle can be observed in many situations, including the following:

- A pigeon is given a small pellet of food every time it turns its body in a complete circle. It begins rotating in circles quite frequently.
- Dolphins who are given fish for "speaking" in dolphinese quickly become quite chatty.
- A boy who completes a perfect spelling paper and is praised for it by a favorite teacher works diligently for future success in spelling assignments.
- A textbook author who receives compliments when she wears her hair in a French braid brushes her hair into a braid more often, especially when going to parties or other social events.

Principles are most useful when they can be applied to many different situations. The "reward" principle—many psychologists instead use the term *reinforcement*—is an example of such broad applicability: It applies to both humans and nonhuman animals and holds true for different types of learning and for a variety of rewards. When a principle such as this one is observed over and over again—when it stands the test of time—it is sometimes called a **law**.

Theories of learning provide explanations about the underlying mechanisms involved in learning. Whereas principles tell us *what* factors are important for learning, theories tell us *why* these factors are important. For example, consider this key idea in social cognitive theory (described in Chapter 5):

> People learn what they pay attention to. A reward increases learning when it makes people pay attention to the information to be learned.

Here we have a possible explanation of why a reward affects learning: It increases attention, which in turn brings about learning.

Principles of learning tend to be fairly stable over time: Researchers observe many of the same factors affecting learning over and over again. In contrast, theories of learning continue to change as new research methods are developed, new research is conducted, and new research findings come to light.

How Theories of Learning Have Evolved over Time

When psychologists first began to study learning in earnest in the late 1800s, the two dominant perspectives in psychology were *structuralism* (e.g., Wilhelm Wundt's work) and *functionalism* (e.g., John Dewey's writings). Although these two perspectives differed considerably in their underlying assumptions and topics of study, they shared a common weakness: They lacked a precise, carefully defined research methodology. The primary means of investigating learning and other psychological phenomena, especially for structuralists, was a method called *introspection:* People were asked to "look" inside their heads and describe what they were thinking.

In the early 1900s, some psychologists began to criticize the introspective approach for its subjectivity and lack of scientific rigor. Without more objective research methods, they argued, psychology as a discipline would never be a true science. They proposed that to study learning in an objective, scientific manner, theorists must focus on two things that can be observed and objectively measured: people's behaviors *(responses)* and the environmental events *(stimuli)* that precede and follow those responses. Since then, many psychologists have attempted to describe

and understand learning and behavior primarily through an analysis of stimulus–response relationships. Such psychologists are called *behaviorists,* and their theories of learning are collectively known as **behaviorism**.

The behaviorist perspective has contributed immensely to our understanding of how people learn and how instructional and therapeutic environments might help them learn and behave more effectively. Over the years, however, its limitations have become apparent. For example, early behaviorists believed that learning can occur only when learners actually behave in some way—perhaps when they make a response and experience the consequences of that response. But in the 1940s, some psychologists proposed that people can also learn a new behavior simply by watching and imitating what *other people* do (N. E. Miller & Dollard, 1941). This idea of *modeling* provided the impetus for an alternative perspective, **social learning theory**, that focused on how people learn from observing those around them.

Behaviorism and social learning theory developed largely in North America. Meanwhile, many early-twentieth-century researchers in Europe took an entirely different tack, presenting situations and tasks that might reveal the nature of people's internal mental processes. For instance, beginning in the 1920s, Swiss researcher Jean Piaget documented numerous ways in which children's reasoning processes change as they grow older, and Russian psychologist Lev Vygotsky conducted studies about how children's social and cultural environments can help them acquire more complex thinking skills. And in Germany, theorists known as **Gestalt** psychologists described a variety of intriguing findings related to such mental phenomena as human perception and problem solving.

Over time, as psychologists continued to explore the various forms that human learning might take, it became clear that a study of behavior alone couldn't give us a complete picture of learning—that we had to take human thought processes, or *cognition,* into account as well. A very different perspective emerged—one known as **cognitive psychology** or, more simply, **cognitivism**—with objective, scientific methods for studying a wide variety of mental phenomena (e.g., Neisser, 1967). Social learning theorists, too, gradually incorporated cognitive processes into their explanations of learning, resulting in a perspective now more often referred to as **social cognitive theory**.

But even with a focus on cognition as well as behavior, we can't completely pinpoint the distinct advantage that we humans have over nonhuman animal species. Many nonhuman animals are *thinking* creatures. For example, several species (e.g., gorillas, chimpanzees, dolphins, elephants—remember Somjai?—and crows) can recognize themselves in a mirror, suggesting that they have a mental image of what they look like (S. T. Parker, Mitchell, & Boccia, 1994; Plotnik, de Waal, & Reiss, 2006; Prior, Schwarz, & Güntürkün, 2008). Furthermore, some animal species can create and use simple tools to get things they want, and they can mentally plan ahead to solve a problem or ensure their future well-being (Emery & Clayton, 2004; Köhler, 1925; Plotnik, Lair, Suphachoksahakun, & de Waal, 2011). Crows, for instance, can craft rudimentary tools to get hard-to-reach food, and they plan ahead by stashing away what they don't immediately eat in locations that they can later remember.

So how can we explain the human advantage in thinking and learning? For one thing, our physical "thinking" equipment—especially the upper part of the brain known as the cortex—is more complex than is true for other species. But in addition, thanks in part to our incredibly flexible language skills, we communicate and collaborate with one another to a much greater extent than other species do, and through the elaborate cultures we've created for ourselves and our communities, we pass along our accumulated knowledge to successive generations

(Tomasello & Herrmann, 2010). Furthermore, our social and cultural environments provide many physical and social support systems (e.g., technology, schools) that can boost our ability to tackle new challenges and problems. Building on Russian psychologist Lev Vygotsky's early ideas, in the past three or four decades some psychologists have developed theories about the critical roles that social interaction and cultural legacies play in human learning and cognitive development. Many labels have been applied to such interaction-and-culture-based perspectives. The most widely used label is **sociocultural theory**, but more broadly we can think of them as **contextual theories**.

Meanwhile, recent technological innovations in the fields of medicine and neurology now enable us to "look inside" the brain—to study its structures and functions in increasing detail (more on such technologies in Chapter 2). Some neurologists, cognitive psychologists, and scientists from other disciplines have teamed up to discover how the brain influences people's behavior and learning, and, conversely, how people's behavior and learning experiences can influence brain development. This rapidly expanding field is known as **cognitive neuroscience** and has already made noteworthy contributions to our understandings of the complexities of human learning.

Figure 1.2 provides a graphic depiction of how various theories of learning have evolved over time. Be careful, however, that you don't interpret the boxes in the figure as depicting mutually exclusive entities. In contemporary psychology, many theorists draw from two or more theoretical perspectives to better capture the complex nature of human thinking and learning (notice the two-way cross-communication arrows between the "Cognitive Psychology," "Social Cognitive Theory," and "Sociocultural Theory and Other Contextual Theories" boxes). As we consider the many aspects of human learning in the chapters ahead, we, too, will occasionally find it helpful to draw from two or more perspectives simultaneously.

Advantages of Theories

Certainly the changeable nature of theories can be frustrating, in that we can never be confident that we have the ultimate truth—the real scoop—on how people learn. Yet it's precisely the dynamic nature of learning theories that enables us to gain increasingly accurate understandings of a very complex, multifaceted phenomenon.

Theories have several advantages over principles. First, they allow us to summarize the results of many, many research studies and integrate numerous principles of learning. In that sense, theories are often quite concise (psychologists use the term *parsimonious*).

Second, theories provide starting points for conducting new research; they suggest research questions worthy of study. If we theorize that rewards bring about learning because they increase a person's attention to whatever needs to be learned, we can make the following prediction:

> When a particular situation or task draws an individual's attention to the information to be learned, learning occurs even in the absence of a reward.

In fact, this prediction has frequently been supported by research (e.g., Cermak & Craik, 1979; Faust & Anderson, 1967; T. S. Hyde & Jenkins, 1969).

Third, theories help us make sense of and explain research findings. Research conducted outside the context of a particular theoretical perspective can yield results that are trivial and nongeneralizable. Interpreted from a theoretical perspective, however, those same results can be quite meaningful. For example, consider an experiment by Seligman and Maier (1967). In this

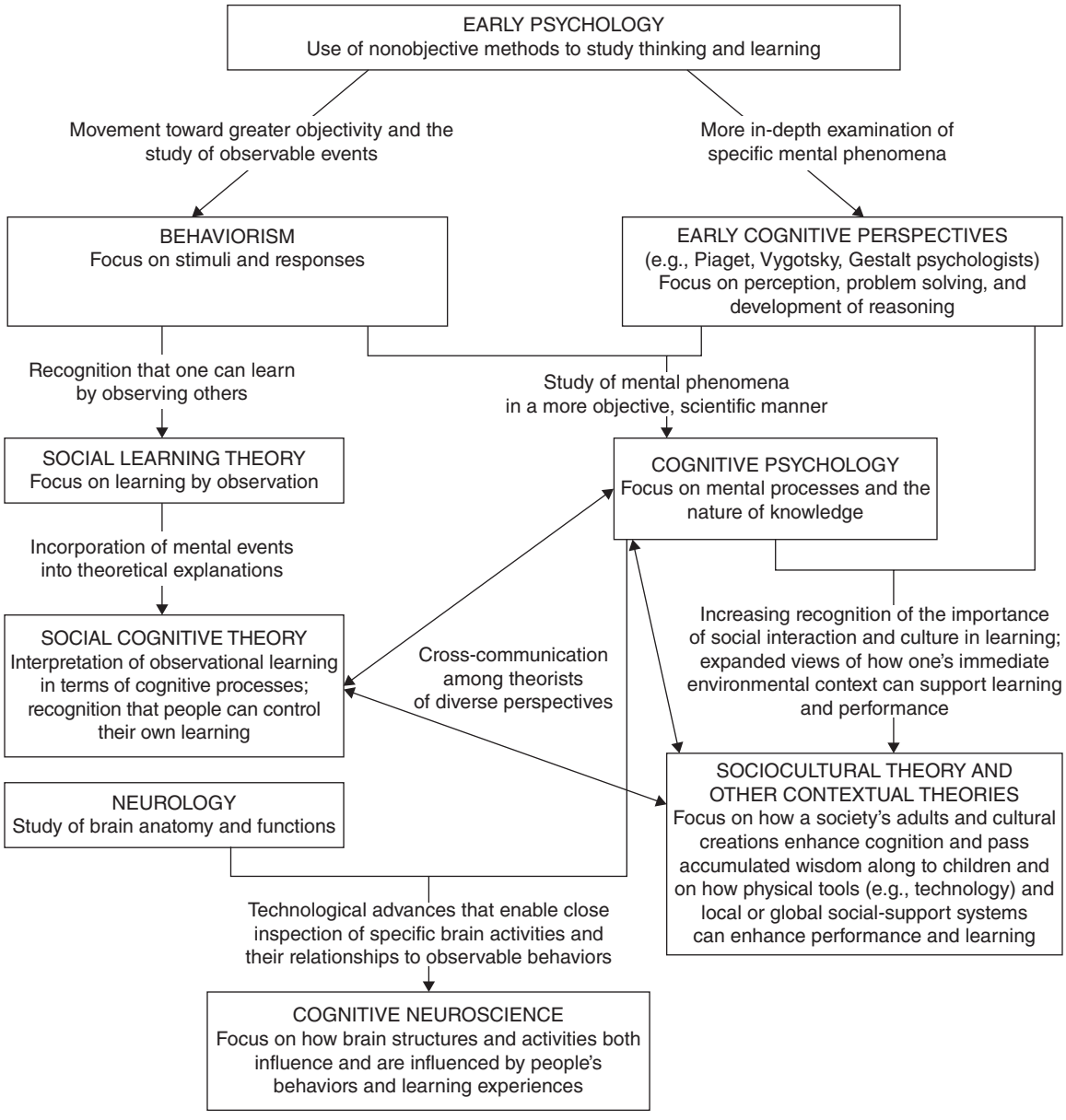

Figure 1.2
Evolution of learning theories over time.

classic study, dogs were placed in individual cages and given a number of painful and unpredictable shocks. Some dogs were able to escape the shocks by pressing a panel in the cage, whereas others were unable to escape. The following day, the dogs were placed in different cages, and again shocks were administered. This time, however, each shock was preceded by a signal (a tone) that the shock was coming, and the dogs could avoid the shocks by jumping over a barrier as soon