

STEPHEN B. KLEIN

LEARNING

Principles and Applications • 8th Edition



LEARNING

8th Edition

This book is dedicated to my wife, Marie, and my children—Dora, David, Jason,
Katherine, and William—for the joy they have brought to my life.

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Principles and Applications

8th Edition

Stephen B. Klein



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PREFACE

*L*earning: *Principles and Applications* seeks to provide students with an up-to-date understanding of learning. Basic principles are described and supplemented by research studies, including classic experiments and important contemporary studies. The eighth edition continues to uphold the same uncompromising scholarship of earlier editions. Psychologists who study the nature of the learning process have uncovered many important principles about the way in which we acquire information about the structure of our environment and how we use this understanding to interact effectively with our environment. As in earlier editions, the eighth edition provides thorough, current coverage of such principles and applications.

Much exciting, new research in learning has occurred in the past few years. Some of the key new discoveries include the determination of conditions that lead to reinforcement being devalued, leading to helplessness and depression; the importance of stimulus context in the acquisition of effective behavior and the elimination of ineffectual behavior; the role of experience in the development of food preferences and aversions; the influence of the conditioning of hunger on overeating and obesity; the recognition that the reinforcing power of psychoactive drugs contributes to addiction; the role of habituation and sensitization on the effectiveness of rewards; the occasion-setting function of conditioned and discriminative stimuli on when and where behavior occurs; and the relevance of memory reconstruction to understanding the validity of eyewitness testimony and repressed memories.

It has become increasingly clear that the nervous system plays a central role in learning processes. The importance of neuroscience on learned behavior will be evident throughout the text. The influence of the amygdala in the limbic system on the development of emotions acquired through Pavlovian conditioning, the role of prefrontal cortex in the encoding of the probability of success and the value of success of choice behavior, and the impact of the hippocampus in the storage and retrieval of experiences are but a few examples where learning is affected by the nervous system.

As in previous editions, the text presents the important contributions of human and nonhuman animal research, as both are crucial to our understanding of the learning process. In many instances, nonhuman animal studies and human research have yielded identical results, indicating the generality of the processes governing learning. While there are many general laws of learning, there are also instances in which species differ in their ability to learn a particular behavior. The use of different animals has shown that biological character affects learning. Furthermore, in some situations, only animal research can be ethically conducted, while in other cases, only human research can identify the learning process that is unique to people.

ORGANIZATION

Based on feedback from users of the previous edition of this textbook, the discussion of traditional theories of learning has been moved from the beginning of the textbook to just before

the discussion of stimulus and cognitive control of behavior. In addition, the discussion of memory storage and retrieval has been expanded into two chapters. As in previous editions, principles and applications of Pavlovian conditioning and theories of Pavlovian conditioning are discussed in separate chapters, while principles and applications of appetitive conditioning and principles and applications of aversive conditioning are also described in separate chapters. The discussion of biological influences on learning follows the description of theories of appetitive and aversive conditioning. Brief descriptions of chapter coverage follow:

Chapter 1 gives a brief introduction to learning as well as a discussion of the origins of behaviorism. The students are first introduced to basic learning principles through a description of the research findings and theories of Thorndike, Pavlov, and Watson. The importance of their work will be evident throughout the text. A brief presentation of the ethics of conducting research is also included in this chapter.

Chapter 2 describes how experience modifies instinctive behavior. This chapter explores three learning processes—(1) habituation, (2) sensitization, and (3) dishabituation—which act to alter neural systems and instinctive behaviors. Opponent-process theory, which describes the affective responses both during and following an event, also is introduced in this chapter.

Chapter 3 details principles and applications of Pavlovian conditioning, a process that involves the acquisition of emotional and reflexive responses to environmental events. The chapter begins by exploring the factors that govern the acquisition or elimination of conditioned responses. Several procedures (higher-order conditioning, sensory preconditioning, and vicarious conditioning) in which conditioned responses can be learned indirectly are described in this chapter. Applications of the Pavlovian conditioning principles that have been used to establish effective conditioned responses and eliminate ineffective or impairing conditioned responses are also presented.

Chapter 4 describes theories of Pavlovian conditioning. This chapter discusses whether the conditioned response is the same or different than the unconditioned response. The conditioning of withdrawal from psychoactive drugs and its relationship to drug overdose is one important topic explored in this chapter. It also examines several theoretical perspectives about the nature of the Pavlovian conditioning.

Chapter 5 discusses principles and applications of appetitive conditioning, a process that involves learning how to behave in order to obtain the positive aspects (reinforcement) that exist in the environment. The variables influencing the development or extinction of appetitive or reinforcement-seeking behavior are described in this chapter. The use of reinforcement to establish appropriate and eliminate inappropriate voluntary behavior also is described in this chapter.

Chapter 6 discusses principles and applications of aversive conditioning, a process that involves learning how to react to the negative aspects (punishers) that exist in our environment. The determinants of escape and avoidance behavior as well as the influence of punishment on behavior are described. Several negative consequences that result from using punishment are also explored in this chapter. This chapter also describes the use of several punishment techniques (positive punishment, response cost, time-out from reinforcement) to suppress inappropriate behavior.

Chapter 7 describes theories of appetitive and aversive conditioning. Theories about the nature of reinforcement and behavioral economics are discussed. Theories about the learning processes that determine choice behavior are one important topic discussed in this chapter. Further, the nature of avoidance learning and punishment is described in this chapter.

Chapter 8 discusses the biological processes that influence learning. In some instances, learning is enhanced by instinctive systems, whereas in others, learning is impaired by our biological character. The role of biological processes in the learning of flavor aversions

and preferences and the acquisition of social attachments are among the topics explored. This chapter also describes the biological processes that provide the pleasurable aspects of reinforcement that can lead to addiction.

Chapter 9 describes traditional learning theory. The theories of Hull, Spence, Guthrie, and Tolman are explored in this chapter. The students will be able to see the changes that have taken place in the understanding of the nature of the learning process during the first half of the 20th century that led to the recognition that both associative and cognitive processes influence behavior.

Chapter 10 discusses the environmental control of behavior and how the stimulus environment can exert a powerful influence on how animals and people act. A discussion of stimulus generalization and discrimination learning is the major focus of the chapter. Special attention is given to understanding the difference between the eliciting and occasion-setting functions of conditioned and discriminative stimuli.

Chapter 11 describes the cognitive processes that affect how and when animals and people behave. This chapter examines the relative contributions of expectations and habits to determining one's actions. The relevance of cognitive learning for understanding the causes of depression and phobias also is discussed in this chapter. A discussion of animal cognition is an important focus of this chapter.

Chapter 12 discusses the memory storage process from the sensory detection of environmental events, to the process of organizing experiences in meaningful ways, and finally to the permanent storage of experiences. This chapter also discusses different types of memory and the biological changes that allow for the long-term storage of experiences as well as when damage to specific biological systems precludes long-term memory storage.

Chapter 13 describes the processes that influence memory retrieval, focusing on the role that affect (emotion) and context have on the retrieval of past experience and the biological systems that allow for that retrieval. Past experience can be forgotten, and this chapter describes two processes, (1) interference and (2) absence or loss of retrieval cues, that lead to forgetting. Memories can be altered after being stored, and this chapter explores the memory reconstruction process and whether individuals can intentionally forget past events. This chapter also discusses mnemonics, a set of strategies to improve memory.

PEDAGOGICAL FEATURES

Pedagogy remains a central feature of this textbook, but approaches have been reworked to enhance their impact in this new edition. In addition, these pedagogical features serve to promote students' understanding of the learning process and to better enable them to see its relevance to their everyday lives.

Vignettes. A vignette opens each chapter, and one chapter includes a vignette within that chapter as well. This pedagogical feature serves three purposes. First, it lets students know what type of material will be presented in the chapter and provides a frame of reference. Second, the vignette arouses the students' curiosity and enhances the impact of the text material. Third, references to the vignette have been incorporated into the text to give it a seamless quality. I have found that students like the chapter opening vignettes, and I believe that their use solidifies the link between the text material and the students' lives.

Learning Objectives. Each chapter begins with six to eight learning objectives. The learning objectives provide the students with the major goals for that chapter and serve as a guide for the students to think about the key ideas that are presented in that chapter.

Coverage of Motivation. One or two motivation sections are presented in most chapters. Associative and cognitive processes influence the motivation process. These sections serve to highlight the important contributions that varied learning processes play in motivating behavior.

Coverage of Neuroscience. The nervous system, especially the brain, plays a central role in translating experience into behavior. Most chapters contain two to four neuroscience sections that allow the students to appreciate the neural systems that control specific learning processes and to recognize that different neural systems govern different behaviors.

Before You Go On Sections. Two critical thinking questions follow each major section and appear throughout each chapter. These questions ensure that students understand the material and allow them to apply this knowledge in original, creative ways. My students report that the use of this pedagogy is quite helpful in understanding what can be difficult concepts.

Applications. Although applications of the text material are presented throughout each chapter, many chapters have at least one stand-alone application section. Many of the discoveries made by psychologists have been applied to solving real-world problems. The application sections enhance the relevance of the abstract ideas presented in the text, showing students that the behaviors described are not just laboratory phenomena.

Photographs and Biographies of Noted Researchers. Each chapter presents the photographs and biographies of individuals who have made significant contributions to an understanding of learning. This pedagogy allows students to gain a better understanding of the principles and applications presented in the text by learning about the background of the individuals whose work contributed to that understanding.

Reviews. A review of key concepts is presented at significant points in each chapter as another tool for students to check their understanding of the material that has just been covered. Once the students have read the chapter, they can easily use the Review sections as a study guide to prepare for examinations.

Critical Thinking Questions. Critical thinking questions in the form of scenarios are presented at the end of each chapter. Answering these questions requires creative application of one or more of the major concepts presented in the chapter, further assisting students in relating the principles presented in the text to situations that they may encounter in the real world.

Key Terms. Each chapter contains a number of key terms. Those key terms are boldfaced where they are discussed within each chapter. A list of those key terms are presented at the end of each chapter and then defined in the Glossary toward the end of the textbook.

ADDITIONAL RESOURCES

At study.sagepub.com/klein8e, instructors using this book can access customizable PowerPoint slides, along with an extensive test bank built on Bloom's taxonomy that features multiple-choice, true/false, and essay/short answer questions for each chapter. Lecture notes, class assignments, and a gallery of figures and tables from the book are also provided.

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My family has been very supportive of my work on this edition, and I am grateful for their help and understanding.

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Stephen B. Klein is a professor in the psychology department at Mississippi State University. He received a BS degree in psychology in 1968 from Virginia Polytechnic Institute and a PhD degree in psychology in 1971 from Rutgers University. Professor Klein taught at Old Dominion University for 12 years and at Fort Hays State University for 7 years prior to coming to Mississippi State University in 1990. He also served as head of the psychology department at both Mississippi State University and Fort Hays State University. Professor Klein has written numerous articles for psychological journals in the area of the biological basis of learning and memory and is the author of *Motivation: Biosocial Approaches*, published by McGraw-Hill in 1982; *Learning: Principles and Applications*, published by McGraw-Hill in 1987, 1991, 1996, and 2002; *Learning: Principles and Applications*, published by SAGE in 2009, 2012, and 2015; and *Biological Psychology*, published by Prentice Hall in 2000. Dr. Klein also coauthored with B. Michael Thorne *Biological Psychology*, published by Worth in 2007, and coedited with Robert Mowrer the two-volume text *Contemporary Learning Theories* in 1989 and *Handbook of Contemporary Learning Theories* in 2001, both published by Lawrence Erlbaum. His family includes his wife, Marie, and five children, Dora, David, Jason, Katherine, and William. In his spare time, he enjoys sports, most passionately baseball, as well as science fiction, especially *Star Trek* and *Star Wars*.

1

AN INTRODUCTION TO LEARNING

LEARNING OBJECTIVES

- 1.1 Define the term *learning*.
- 1.2 Describe the way instincts affect behavior according to functionalism.
- 1.3 Explain how associations are formed according to the British empiricists.
- 1.4 Recall the way Thorndike investigated the effect of rewards on behavior.
- 1.5 Explain how Pavlov showed that digestive responses could be conditioned.
- 1.6 Recount how Watson showed that emotions could be learned.
- 1.7 Discuss how to conduct ethical animal and human research.

THE GIFT OF KNOWLEDGE

Suzanne entered college 2 years ago with the intention to study biology and go to medical school. However, over the past year, she has found several psychology courses more exciting and challenging than her biology classes, and she now wants to become a clinical psychologist. Suzanne's concern over her younger brother Marcus's drug problems has stimulated this interest in psychology. Marcus, an excellent student before he began to experiment with drugs several years ago, is now addicted to heroin, has quit school, and has lost countless jobs. He has been in rehab several times and overdosed three times, only to be saved by the administration of Narcan by paramedics. Suzanne wants to understand the factors that can lead to drug addiction and why it is so hard to quit. She hopes to contribute someday to the development of an effective drug addiction therapy. Dr. Martinez, Suzanne's adviser, suggested that Suzanne enroll in a course on learning in

order to obtain a degree in psychology. However, spending endless hours reading about rats running through mazes or pigeons pecking at keys did not appeal to Suzanne. Interested in the human aspect of psychology, Suzanne wondered how this course would benefit her. In spite of this, she trusted Dr. Martinez's advice, so she enrolled in the class. Suzanne soon found out that her preconceived ideas about the learning course were incorrect and how understanding learning principles would benefit the student of clinical psychology.

As Suzanne discovered, learning involves the acquisition of behaviors that are needed to obtain reward or avoid punishment. It also involves an understanding of when and where these behaviors are appropriate. The principles that govern the learning process have been revealed with both human and nonhuman research. The experiments described in Suzanne's learning class were far from boring and made the learning principles described in class seem real.

Suzanne now thinks that the knowledge gained from the learning class will undoubtedly help in her search for an effective treatment of addictive behavior. You will learn from this book what Suzanne discovered about learning in her course. I hope your experience will be as positive as hers. We begin our exploration by defining learning.

A DEFINITION OF LEARNING

1.1 Define the term *learning*.

Learning can be defined as a relatively permanent change in behavior potential that results from experience. This definition of learning has two important components. First, learning reflects a change in the potential for a behavior to occur; it does not automatically lead to a change in behavior. We must be sufficiently motivated to translate learning into behavior. For example, although you may know the location of the campus cafeteria, you will not be motivated to go there until you are hungry. Also, we are sometimes unable to exhibit a particular behavior even though we have learned it and are sufficiently motivated to exhibit it. For example, you may learn from friends that a new movie has gotten great reviews, but you do not now have the money to go.

Second, the behavior changes that learning causes are not always permanent. As a result of new experiences, previously learned behavior may no longer be exhibited. For example, you may learn a new and faster route to class and no longer take the old route. Also, we sometimes forget a previously learned behavior and therefore are no longer able to exhibit that behavior. Forgetting the story line of a movie is one instance of the transient aspect of learning.

It is important to note that changes in behavior can be due to performance processes (e.g., maturation, motivation) rather than learning. Our behavior can change as the result of a motivational change rather than because of learning. For example, we eat when we are hungry or study when we are worried about an upcoming exam. However, eating or studying may not necessarily be due to learning. Motivational changes, rather than learning, could trigger eating or studying. You have already learned to eat, and your hunger motivates your eating behavior. Likewise, you have learned to study to prevent failure, and your **fear** motivates studying behavior. These behavior changes are temporary; when the motivational state changes again, the behavior will also change. Therefore, you will stop eating when you are no longer hungry and quit studying when you no longer fear failing the examination. Becoming full or unafraid and ceasing to eat or study is another instance when a temporary state, rather than learning, leads to a change in behavior.

Many behavioral changes are the result of maturation. For example, a young child may fear darkness, while an adult may not show an emotional reaction to the dark. The change

in emotionality could reflect a maturational process and may not be dependent on experiences with darkness. Another example of the impact of maturation is a child who cannot open a door at age 1 but can do so at age 2. The child may have learned that turning the doorknob opens the door, but physical growth of the child is necessary for the child to reach the doorknob.

Not all psychologists agree on the causes of behavior. Some even argue that instinct, rather than experience, determines behavior. We begin our discussion by examining the view that instinctive processes govern human actions. Later in the chapter, we explore the origins of behaviorism—the view that emphasizes the central role of experience in determining behavior. Throughout the rest of the text, we discuss what we now know about the nature of learning.

FUNCTIONALISM

1.2 Describe the way instincts affect behavior according to functionalism.

Functionalism was an early school of psychology that emphasized the instinctive origins and adaptive function of behavior. According to this theory, the function of behavior is to promote survival through adaptive behavior. The functionalists expressed various ideas concerning the mechanisms controlling human behavior. The father of functionalism, John Dewey (1886), suggested that, in humans, the mind replaced the reflexive behaviors of lower animals, and the mind has evolved as the primary mechanism for human survival. The mind enables the individual to adapt to the environment. The main idea in Dewey's functionalism was that the manner of human survival differs from that of lower animals.

In contrast to Dewey, William James, also a 19th-century psychologist, argued that the major difference between humans and lower animals lies in the character of their respective inborn or instinctual motives. According to James (1890), human beings possess a greater range of **instincts** that guide behavior (e.g., rivalry, sympathy, fear, sociability, cleanliness, modesty, and love) than do lower animals. These social instincts directly enhance (or reduce) our successful interaction with our environment and, thus, our survival. James also proposed that all instincts, both human and nonhuman, have a mentalist quality, possessing both purpose and direction. Unlike Dewey, James believed that instincts motivated the behavior of both humans and lower animals.

Some psychologists (see Troland, 1928) who opposed a mentalist concept of instinct argued that internal biochemical forces motivate behavior in all species. Concepts developed in physics and chemistry during the second half of the 19th century provided a framework for this mechanistic approach. Ernst Brücke (1874) stated in his *Lectures on Physiology* that “the living organism is a dynamic system to which the laws of chemistry and physics apply”—a view that led to great advances in physiology. This group of functionalists used a physiochemical approach to explain the causes of human and animal behavior.

A number of scientists strongly criticized the instinct concept that the functionalists proposed. First, anthropologists pointed to a variety of values, beliefs, and behaviors among different cultures, an observation inconsistent with the idea of universal human instincts. Second, some argued that the widespread and uncritical use of the instinct concept did not advance our understanding of the nature of human behavior. Bernard's (1924) analysis illustrates the weaknesses of the instinct theories of the 1920s. Bernard identified several thousand often-conflicting instincts the functionalists had proposed. For example, Bernard described one instinct as “with a glance of the eye we can estimate instinctively the age of a passerby” (p. 132). With this type of proposed “instinct,” it is not surprising that many psychologists reacted so negatively to the instinct concept.

In the 1920s, American psychology moved away from the instinct explanation of human behavior and began to emphasize the learning process. The psychologists who viewed experience as the major determinant of human actions were called behaviorists. Contemporary views suggest that behavior is traceable to both instinctive and experiential processes. In Chapter 2, we look at instinctive processes and how experience alters instinctive reactions. In this chapter, we briefly examine the behaviorists' ideas concerning the nature of the learning process. We discuss theories about the nature of the learning process throughout the text.

BEHAVIORISM

1.3 Explain how associations are formed according to the British empiricists.

Behaviorism is a school of thought that emphasizes the role of experience in governing behavior. According to behaviorists, the important processes governing our behavior are learned. We learn both the motives that initiate behavior and specific behaviors that occur in response to these motives through our interaction with the environment. A major goal of the behaviorists is to determine the laws governing learning. A number of ideas contributed to the behavioral view. The Greek philosopher Aristotle's concept of the association of ideas is one important origin of behaviorism.

The Importance of Associations

Suppose a friend approaches you after class and remarks that your party last week was terrific. This remark causes you to recall meeting a very attractive person at your party, which in turn reminds you to ask this person for a date. This whole thought process reflects the concept of the association of ideas: Two events become associated with each other; thus, when you think of one event, you automatically recall the other. Aristotle proposed that in order for an **association** to develop, the two events must be contiguous (temporally paired) and either similar to or opposite each other.

British Empiricism

During the 17th and 18th centuries, British empiricists described the association process in greater detail. John Locke (1690/1964) suggested that there are no innate ideas, but instead we form ideas as a result of experience. Locke distinguished simple from complex ideas. **Simple ideas** are passive impressions received by the senses, or the mind's representation of those sensory impressions. In contrast, **complex ideas** represent the combination of simple ideas, or the association of ideas. The following example illustrates the difference between simple and complex ideas. You approach a rose in a garden. Your senses detect the color, odor, and texture of the rose. Each of these sensory impressions represents a simple idea. Your mind also infers that the smell is pleasant, which also is a simple idea. The combination or association of these simple ideas creates the perception of a rose, which is a complex idea.

David Hume (1748/1955) hypothesized that three principles connect simple ideas into a complex idea. One of these principles is **resemblance**, the second is **contiguity** in time or place, and the third is **cause and effect**. Hume's (1748/1955) own words best illustrate these three principles, which, he proposed, are responsible for the association of ideas:

A picture naturally leads our thoughts to the original [resemblance]. The mention of the apartment in a building naturally introduces an inquiry . . . concerning the others [contiguity]; and if we think of a wound, we can scarcely forebear reflecting on the pain which follows it [cause and effect]. (p. 32)

Locke and Hume were philosophers, and it was left to later scientists to evaluate the validity of the principle of the association of ideas. One of these scientists was Edward Thorndike, whose work we discuss next.

THORNDIKE

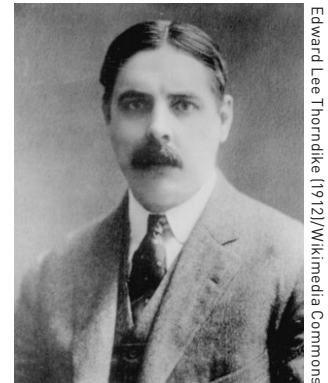
1.4 Recall the way Thorndike investigated the effect of rewards on behavior.

The work of Edward Thorndike had an important influence on the development of behaviorism. Thorndike's 1898 publication of his studies established that animal behavior could change as a consequence of experience. Thorndike's ideas on learning and motivation developed from his research with his famous puzzle boxes (see **Figures 1.1a and 1.1b**). He tested 13 kittens and young cats in 15 different puzzle boxes. In his studies, he placed a hungry cat in a locked box and put food just beyond its reach, outside the box. The cat could escape to obtain food by exhibiting one of a number of possible behaviors. A different response or sequence of responses was required to activate a release mechanism and escape from each box. For example, two effective behaviors were pulling on a string and pressing a pedal.

Thorndike (1898) observed that when a cat was initially placed into the puzzle box, the cat would engage in a number of behaviors, such as clawing, biting, meowing, and rubbing. Eventually, the cat would respond in a way that activated the release mechanism and opened the door to the puzzle box. The cat would then escape from the puzzle box and consume the food outside. On subsequent trials, the cat would engage in the other behaviors but eventually would respond in the manner needed to activate the release mechanism and escape from the puzzle box. Thorndike found that not only did the cats escape but with each successive trial, the time needed to activate the release decreased (see **Figure 1.2**). Further, Thorndike observed that the time the cat spent engaging in the other behaviors declined until the only behavior seen in the puzzle box was the one that activated the release mechanism.

Thorndike (1898) proposed that the cat formed an association between the stimulus (the box) and the effective response. Learning, according to Thorndike, reflects the development of a stimulus–response (S–R) association. As the result of learning, the presence of the stimulus elicits the appropriate response. Thorndike asserted that the animal is not conscious of this association but is instead exhibiting a mechanistic **habit** in response to a particular stimulus. The S–R connection developed because the cat received a **reward**: The effective response resulted in the cat obtaining a reward (food), which produced a satisfying state and strengthened the S–R bond. Thorndike labeled this strengthening of an S–R association by reward or a satisfying state the **law of effect**. Thus, the law of effect selects the appropriate response and connects it to the environment, thereby changing a chance act into a learned behavior.

Thorndike did not think that the law of effect applied only to animal behavior; he argued that it also describes the human learning process. Thorndike (1932) presented his human subjects with a concept to learn. Telling his subjects that they had responded correctly enabled the subjects to learn the appropriate response.

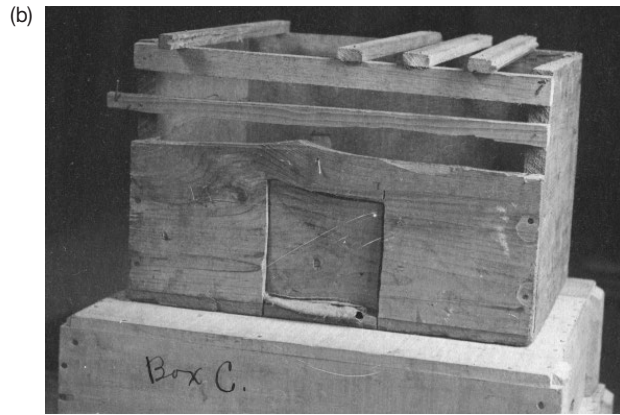
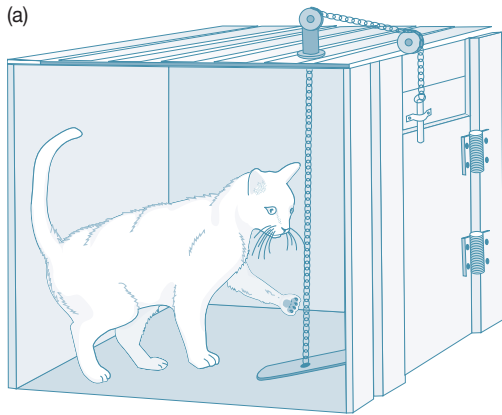


Edward Lee Thorndike (1912)/Wikimedia Commons

Edward Lee Thorndike (1874–1949)

Thorndike studied under William James at Harvard University. This began his research on associative learning in animals, in James's basement, when he was unable to secure research space at Harvard. He continued his animal learning studies at Columbia University, where he obtained his doctorate under the direction of James McKeen Cattell, who is considered one of the founding fathers of psychometrics. He then taught for 36 years at Teachers College, Columbia University. Considered a pioneer in the field of educational psychology, he applied the psychological principles to the teaching of reading, language acquisition, and intelligence testing. He served as president of the American Psychological Association in 1912.

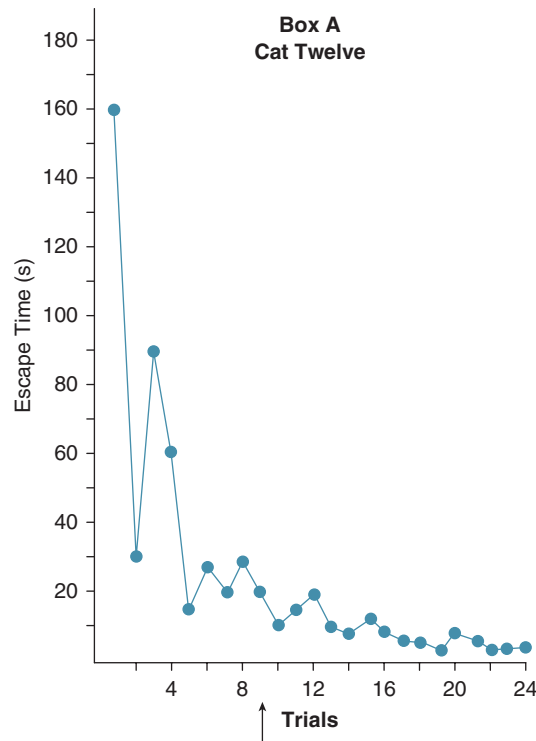
FIGURE 1.1 ■ Thorndike's famous puzzle box: The hungry cat can escape and obtain access to food by exhibiting the appropriate response (a). Photograph of Thorndike's puzzle box C (b).



Source: Adapted from Swenson, L. C. (1980). *Theories of learning: Traditional perspectives/contemporary developments*. Belmont, CA: Wadsworth. Copyright © Leland Swenson.

Source: Robert M. Yerkes Papers, Manuscripts and Archives, Yale University Library.

FIGURE 1.2 ■ The escape time of one cat declined over 24 trials in one of Thorndike's puzzle boxes.



Source: From Thorndike, E. L. (1898) *Animal intelligence: An experimental study of the associative process in animals. Psychological Review Monograph*, 2 (Suppl. 8). Copyright 1898 by the American Psychological Association. Reprinted with permission.

The law of effect concept proposed by Thorndike became one of the central tenets of behaviorism. Reward definitely has a powerful influence on human behavior, whether it be studying to obtain a high score on the Graduate Record Examination (GRE) or the Law School Admission Test (LSAT) or a subpar score in a round of golf. We will have much more to say about the law of effect in Chapter 5.

Although Thorndike's views concerning the nature of the learning process were quite specific, his ideas on the motivational processes that determine behavior were vague. According to Thorndike (1898), learning occurs, or a previously learned behavior is exhibited, only if the animal or human is "ready." Thorndike's **law of readiness** proposes that the animal or human must be motivated to develop an association or to exhibit a previously established habit. Thorndike did not hypothesize about the nature of the motivation mechanism, leaving such endeavors to future psychologists. Indeed, the motivational basis of behavior became a critical concern of the behaviorists.

Thorndike (1913) suggested a second means by which learning can occur. According to Thorndike, associating the stimulus that elicited a response with another stimulus could result in the association of that response with the other stimulus. Thorndike referred to this learning process as **associative shifting**. To illustrate the associative shifting process, consider Thorndike's example of teaching a cat to stand up on command. At first, a piece of fish is placed in front of a cat; when the cat stands to reach the fish, the trainer says, "Stand up." After a number of trials, the trainer omits the fish stimulus, and the verbal stimulus alone can elicit the standing response, even though this S–R association has not been rewarded. Although Thorndike believed that conditioning, or the development of a new S–R association, could occur through associative shifting, he proposed that the law of effect, rather than associative shifting, explains the learning of most S–R associations. In the next section, we will discover that Thorndike's associative shifting process bears a striking resemblance to Pavlovian conditioning.

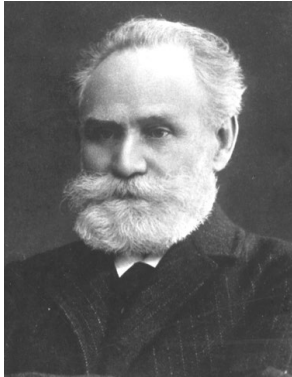
Before You Go On

- What could Suzanne learn about drug addiction from our discussion of behaviorism?
- How could Suzanne use Thorndike's law of effect to explain a possible cause of drug addiction?

Review

- Learning is a relatively permanent change in behavior potential that results from experience.
- The functionalists emphasized the instinctive character of human behavior but could not agree on the nature of instinctive processes or the number of instincts.
- The behaviorists' view is that most human behavior is due to experience.
- The British empiricists proposed that associations can be learned as a result of resemblance, contiguity, and cause and effect.
- Thorndike repeatedly placed hungry cats in a puzzle box and found that the cats increasingly used the behavior that enabled them to escape from the box and obtain food.

- Thorndike believed that the effect of the food reward was to strengthen the association between the stimulus of the puzzle box and the effective response.
- Thorndike's law of readiness proposed that motivation was necessary for learning to occur.
- Thorndike believed that association of a stimulus that elicited a response with another stimulus results in the other stimulus also eliciting the response through the associative shifting process.



**Ivan Petrovich Pavlov
(1849–1936)**

Pavlov received a doctorate in physiology from the University of Saint Petersburg and for 45 years directed the Department of Physiology at the Institute of Experimental Medicine, which became a leading center of physiological research. His early research was on the physiology of pancreatic nerves. He received the 1904 Nobel Prize in Physiology or Medicine for his work on physiology of digestion. He is most noted for his studies on the conditioning of digestive reflexes. Toward the end of his career, he turned his attention to the use of conditioning to induce experimental neurosis in animals by overtraining the excitatory or the inhibitory process, or by quickly alternating excitation and inhibition. He continued to work in his lab until the age of 87. His lectures are in the public domain and can be read at www.ivanpavlov.com.

PAVLOV

1.5 Explain how Pavlov showed that digestive responses could be conditioned.

How did the cat select the correct response in Thorndike's puzzle box studies? Thorndike explained the process as one of trial and error; the cat simply performed various behaviors until it discovered a correct one. Reward then functioned to strengthen the association of the stimulus environment with that response. However, the research of Ivan Pavlov (1927) suggests that the learning process is anything but trial and error. According to Pavlov, definite rules determine which behavior occurs in the learning situation.

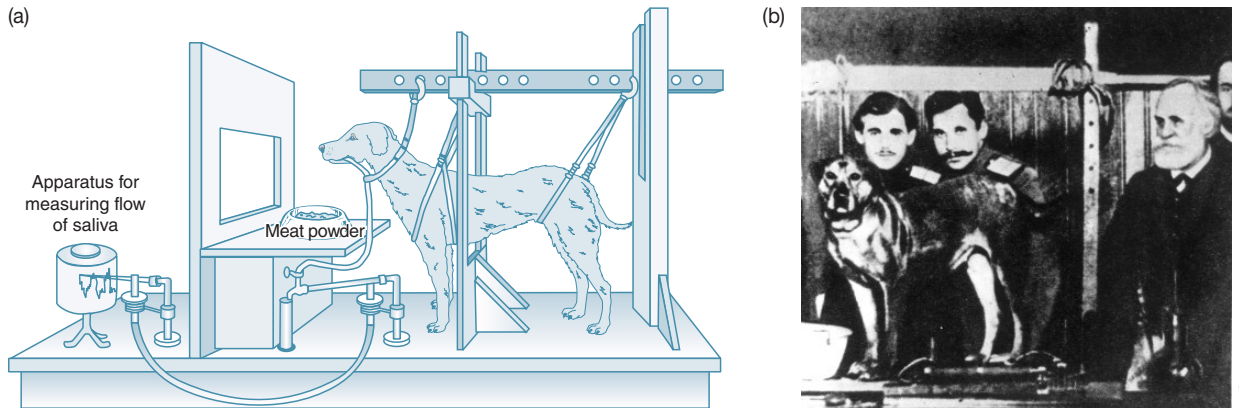
Pavlov was a physiologist, not a psychologist; his initial plan was to uncover the laws governing digestion. He observed that animals exhibit numerous reflexive responses when food is placed in their mouths (e.g., salivation, gastric secretion). The function of these responses is to aid in the digestion process.

Pavlov observed during the course of his research that his dogs began to secrete stomach juices when they saw food or when it was placed in their food dishes. He concluded that the dogs had learned a new behavior because he had not observed this response during their first exposure to the food. To explain his observation, he suggested that both humans and nonhuman animals possess innate or unconditioned reflexes. An **unconditioned reflex** consists of two components—an **unconditioned stimulus** (UCS; e.g., food), which involuntarily elicits the second component, the **unconditioned response** (UCR; e.g., release of saliva). A new or **conditioned reflex** develops when a neutral environmental event occurs along with the UCS. As conditioning progresses, the neutral stimulus becomes the **conditioned stimulus** (CS; e.g., the sight of food) and is able to elicit the learned or **conditioned response** (CR; e.g., the release of saliva).

The demonstration of a learned reflex in animals was an important discovery, illustrating not only an animal's ability to learn but the mechanism responsible for the learned behavior. According to Pavlov, any neutral stimulus paired with a UCS could, through conditioning, develop the capacity to elicit a CR. In his classic demonstration of the **Pavlovian conditioning** process, he first implanted a tube, called a fistula, into a dog's salivary glands to collect saliva (see **Figures 1.3a and 1.3b**). He then presented the CS (the sound of a metronome) and shortly thereafter placed the UCS (meat powder) into the dog's mouth. On the first presentation, only the meat powder produced saliva (UCR). However, with repeated pairings of the metronome with food, the metronome sound (CS) began to elicit saliva (CR), and the strength of the CR increased with increased pairings of the conditioned and unconditioned stimuli.

Pavlov conducted an extensive investigation of the conditioning process, identifying many procedures that influence an animal's learned behaviors. Many of his ideas are still accepted today. He observed that stimuli similar to the CS can also elicit the CR through a process

FIGURE 1.3 ■ Pavlov's salivary-conditioning apparatus. The experimenter can measure saliva output when either a conditioned stimulus (e.g., the tick of a metronome) or an unconditioned stimulus (e.g., meat powder) is presented to the dog. The dog is placed in a harness to minimize movement, thus ensuring an accurate measure of the salivary response (a). Pavlov and his colleagues demonstrating conditioning at the Military Academy in St. Petersburg, Russia, in 1905 (b).



Source: Adapted from Yerkes, R. M., & Margulis, S. (1909). The method of Pavlov in animal psychology. *Psychological Bulletin*, 6, 257–273. Copyright 1909 by the American Psychological Association. Reprinted with permission.

he called **generalization**; further, the more similar the stimulus is to the CS, the greater the generalization of the CR. Pavlov also showed that if, after conditioning, the CS is presented without the UCS, the strength of the CR diminishes. Pavlov named this process of eliminating a CR **extinction**.

Pavlov's observations had a profound influence on psychology. The conditioning process he described has been demonstrated in various animals, including humans. Many different responses can become CRs and most environmental stimuli can become conditioned stimuli. Most human emotions are acquired through Pavlovian conditioning, whether it is a positive emotion such as liking a friend or a negative emotion such as disliking the neighborhood bully. We will have much more to say about Pavlovian conditioning in Chapters 3 and 4.

WATSON

1.6 Recount how Watson showed that emotions could be learned.

The learning processes Thorndike and Pavlov described became the foundation of behaviorism. However, it was John B. Watson who was responsible for the emergence of behaviorism as the dominant point of view in American psychology. Watson's *Psychology from the Standpoint of a Behaviorist* was first published in 1919. His introductory psychology text presented a coherent S–R view of human behavior, which was extremely successful and provided the structure for later behavioral theories.

Although Pavlov's research excited Watson, the work of another Russian, Vladimir Bechterev, was an even greater influence. Whereas Pavlov used positive or pleasant UCSs,