

Stephen B. Klein

LEARNING

**Principles and
Applications**

LEARNING: PRINCIPLES AND APPLICATIONS

Stephen B. Klein

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IN MEMORY OF MY FATHER,
CLARENCE

AND TO MY MOTHER,
BEVERLY

FOR THEIR LOVE, INSPIRATION,
AND GUIDANCE

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LEARNING: PRINCIPLES AND APPLICATIONS

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PREFACE

Psychologists have spent most of this century intensively studying the learning process. They have uncovered many important aspects of how we acquire information about the structure of our environment and how we use this understanding to interact effectively with that environment. This book describes what psychologists have discovered about the nature of the learning process.

Chapter 1 provides a description of learning theory, including what changes have taken place in learning theory during this century and how contemporary views of the learning process have been shaped by the ideas expressed by previous generations of psychologists.

Chapter 2 details Pavlovian conditioning, a process which involves learning when events will or will not occur. This chapter discusses the factors which govern the acquisition or elimination of conditioned responses.

Chapters 3 and 4 describe instrumental conditioning, the process of learning how to behave to obtain the positive aspects (rewards) and avoid the negative aspects (punishers) of our environment. The variables influencing the development or extinction of appetitive or reward-seeking behavior are described in Chapter 3, and Chapter 4 presents the determinants of avoidance behavior.

Chapter 5 discusses the environmental control of behavior and how the stimulus environment can exert a powerful influence on how we act. Cognitions can also have an important influence on our actions, and Chapter 6 describes the cognitive processes which affect how and when we behave.

Chapter 7 details three complex learning processes: how we identify concepts, solve problems, and learn to use language. Chapters 8 and 9 discuss memory, the process which allows us to retain our experiences into the future. The nature of memory storage is described in Chapter 8, and the processes which allow us to retrieve experiences are detailed in Chapter 9. Chapter 9 also discusses the causes of forgetting. Further, the biological basis of memory storage and retrieval is presented in these chapters.

Chapter 10 provides a discussion of the biological processes which influence learning. In some instances, biological systems enhance learning; in other

cases, learning is impaired by our biological character. Chapter 10 also describes the biological processes which provide the pleasurable aspects of reward and the negative aspects of punishment.

This book presents the important contributions of both animal and human research, since both are crucial to our understanding of the learning process. In many instances, animal studies and human experimentation have yielded identical results, indicating the generality of the processes governing learning. Although there are many general laws of learning, in some instances species differ in their ability to learn a particular behavior. The use of different animals has shown that biological character affects learning. In some situations, only animal research can be ethically conducted, whereas in other cases only human research can identify the learning process which is unique to people. This book describes the research necessary to illustrate a specific learning process.

Several features have been incorporated into this book to increase the relevance of the abstract concepts which describe the nature of learning. At the beginning of each chapter is a vignette intended to give you a preview of the material to be presented in that chapter as well as to stimulate your interest. Many real-world examples of learning concepts are provided throughout the text, and it is hoped that these examples will allow you to recognize instances where the abstract concepts detailed in the text occur in the real world. Applications of the basic concepts described in the textbook are included to demonstrate that the basic learning principles have been successfully used to alter behavior. My students have appreciated the balanced approach between a description of basic learning processes and a presentation of how these basic principles govern our behavior. I hope that you, too, will like this approach.

The textbook has had input from many people I thank the students in my learning classes who read drafts of the chapters and pointed out which sections they liked, which they disliked, and which were unclear. Not only was their feedback very helpful to me, but I am certain that it contributed to the readability and quality of the text.

The staff at McGraw-Hill played an important role in the creation of this text. The psychology editors, James D. Anker, Pat Nave, and David Serbun, guided the development of the text from its inception to this final product. Barbara Chernow, the editing supervisor, ensured that the text was not only easy to read but also aesthetically appealing.

I also thank my colleagues who reviewed chapters of the text. I am especially grateful to Dr. John D. Batson, Furman University; Dr. Michael R. Best, Southern Methodist University; Dr. E. John Capaldi, Purdue University; Dr. Alexis C. Collier, Ohio State University; Dr. Roy E. Connally, University of Central Florida; Dr. Robert G. Crowder, Yale University; Dr. James J. D'A-mato, Rockland Community College; Dr. Hiram E. Fitzgerald, Michigan State University; Dr. Robert Henderson, University of Illinois at Urbana-Champaign; Dr. Charles F. Hinderliter, University of Pittsburgh; Dr. Craig T. Johnson, Towson State University; Dr. John M. Knight, Central State University; Dr. Harry MacKay, Northeastern University; Dr. Robert M. Markley, Fort

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Stephen B. Klein

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THEORETICAL APPROACHES TO LEARNING

THE GIFT OF KNOWLEDGE

Robert entered college three years ago to become a lawyer. His interest in the law had been spurred by a United States law course he had taken in high school. However, during the past year, several psychology courses have proved more exciting and challenging than his political science classes, and he now wants to obtain a degree in clinical psychology. Robert's interest in psychology has also been stimulated by his younger sister Sarah's drug problems. Sarah, an excellent student before she began to experiment with drugs several years ago, is now addicted, has quit school, and has left home. Robert wants to understand the factors which lead to addictive behavior, and he hopes to contribute someday to the development of an effective drug-addiction therapy.

Dr. Carson, Robert's advisor, suggested that he enroll in a course on learning to fulfill the psychology department's degree requirements. Spending endless hours watching rats run through mazes and analyzing pages and pages of data did not appeal to Robert. Interested in the human aspect of psychology, Robert wondered how this course would benefit him. However, he worried that not taking the course would adversely affect Dr. Carson's evaluation of him for graduate school; therefore, Robert enrolled in the class.

Robert soon discovered that his preconceived ideas about the learning course were incorrect. The course covered both animal and human research, and Robert found that the various types of experimentation complemented each other in revealing the nature of the learning processes which govern behavior. The experiments, far from boring, made the learning principles described in class seem real. Robert discovered that learning involves the devel-

opment of effective methods to obtain reward and to avoid adversity as well as an understanding of when and where these responses are appropriate. Robert was interested to learn how basic research has stimulated the development of techniques for modifying behavior and how understanding the principles of learning benefits even the most ardent student of clinical psychology.

Although psychology has changed dramatically during the past two decades, contemporary learning theory represents a synthesis of the theories proposed by previous generations of psychologists. Although Robert expected to find the study of psychology's past irrelevant, instead he found that these ideas have shaped and determined modern psychology. He found that the learning process is governed by complex, yet lawful, principles. For instance, Robert discovered that although psychologists had attempted to use a single stimulus-response approach to describe the learning process, contemporary psychology now recognizes that several processes are involved in the acquisition or elimination of a behavior.

Robert now thinks that the knowledge gained from the learning class will undoubtedly help him search for an effective treatment of addictive behavior. You will learn from this book what Robert discovered about the learning process in his course. I hope that your experience will be as positive as his.

A DEFINITION OF LEARNING

What is *learning*? Learning is a *relatively permanent change in the ability to exhibit a behavior; this change occurs as the result of successful or unsuccessful experience*. This definition of learning has three important components: First, the change in behavior must be relatively permanent to be considered an example of learning. We often alter our behavior as the result of motivational changes. For example, we eat when we are hungry or study when we are worried about an upcoming exam. However, learning is not necessarily responsible for our behavior. If eating or studying behaviors have already been learned, motivational changes rather than learning trigger the change in behavior. Thus, 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 behavioral 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. You should recognize that learning is not always permanent. Our actions often change as the result of new experiences, which occurs when previously learned behaviors are no longer effective. Also, there are times when we forget a previously learned behavior, and therefore, we are no longer able to exhibit that behavior.

Second, learning reflects a change in the potential for a behavior. Learning 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 might be 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 good movie is playing but not go because you cannot afford it.

Third, many examples of behavioral change do not reflect the learning process. Lornez (1966) described many situations in which experience alters instinctive behavior. The following examples demonstrate that adaptive modification produced by experience is often programmed into a species's genetic makeup.

Automobiles once had to be driven several hundred miles before they operated at peak efficiency. Likewise, many response systems become more efficient with experience. For example, Wells (1962) discovered that practice improves a young squid's prey-catching ability. Although a young squid's prey-catching form is the same as an adult squid's form, the young squid's response is slower and less certain than the adult's. Also, Hess (1956) observed that the aim of young chickens' food-pecking response improves with experience. To demonstrate that practice rather than success caused the improvement, Hess put goggles on the chicks which caused the food to appear to be several inches from the actual location. Wearing the goggles, the chicks always missed the food; however, the more they pecked, the closer they came to the perceived location of the food. Thus the improvement in pecking behavior was unrelated to the chicken's success in obtaining food.

We have discovered that learning represents a relatively permanent change in the potential for a behavior, a change which develops through successful or unsuccessful experience. Let's now examine the historical origins of this definition and of contemporary learning theory.

HISTORICAL ORIGINS

Early Philosophical Thought

Why are you taking this learning course? Perhaps you found the material on learning in your introductory psychology course interesting and want to know more about the learning process. Or you might believe that a high grade in this course will enhance your chances of being accepted to a good graduate school. Either of these reasons (or another of your own) suggests that you know why you are taking this course and that you freely chose to participate in the class in accordance with your motivation. Your behavior is consistent with the theories by which early philosophers such as Aristotle and Plato portrayed human nature. They believed that people have *free will* and that behavior is governed by intellect and reason. Thus, if we behave in a socially inappropriate manner, we have freely chosen that behavior and are, therefore, accountable for our actions.

In the seventeenth century, René Descartes described his dualistic view of animal and human behavior in which different processes motivate animal and human action. Descartes proposed that animals are similar to small ma-

chines in that their behavior is mechanistic and determined by their internal processes—instincts and reflexes. Unlike human beings, they have neither reasoning abilities nor free will. Having no “mind,” lower animals cannot be held accountable for their behavior. Human beings, however, can determine their own fate; their minds control their actions, whereas the body determines the behavior of a lower animal. According to the eighteenth-century philosopher Immanuel Kant, our knowledge and rationality should control our passions and our body. In 1859, Charles Darwin’s *On the Origin of Species* challenged this idealized view of the nature of humans as a unique and essentially cerebral species; his theory admitted the animal nature present in all of us.

Darwin’s Influence

The idea that the process which motivates the behavior of humans is distinctively different from that of lower animals came under attack just over a century ago; the controversy concerning the nature of human behavior still rages. Darwin proposed that the differences between humans and lower animals are quantitative rather than qualitative—that the major force motivating all animals, including humans, is survival. Humans may be more adept at survival, but the same general process determines the nature of both humans and lower animals. According to Darwin, survival requires that animals and humans possess specific characteristics—both behavioral and physical—which are *adaptive* to their environment. If an animal, either human or nonhuman, has these characteristics, then it will survive. For example, a deer that can run faster than its predator will survive. In contrast, animals or humans that do not possess the adaptive characteristics will perish; the slow deer becomes the cougar’s meal. Darwin’s phrase “survival of the fittest” merely reflects his observation that in an environment with limited resources, only the able creatures will live to reproduce. The importance—and one obviously controversial aspect—of Darwin’s theory is the assumption that human beings are not unique but are motivated by the same factors that influence the behavior of other animals.

A central aspect of Darwin’s theory is his concept of evolution. Darwin asserted that each successful species possesses characteristics enabling it to survive in a particular environment. When an environment changes, the species must either respond to that change or become extinct. If the environmental change is a slow one, some members of the species may adapt through adventitious genetic mutations; others may possess characteristics adaptive to their new environment; they alone will live to reproduce, passing along to their offspring their adaptive characteristics. Thus, the species changes due to the selective loss of some group members. For example, if an environment becomes colder, only those bears with a very thick coat will survive, and future generations of bears will have thicker coats than the average in the preceeding generations. If the environment should continue to change, a different species of animal will evolve—a species that is adapted to the new environment. Unfortunately, too rapid a change in the environment typically results in extinc-

tion of the species. *Evolution* represents the changes of the behavioral and physical characteristics that a species undergoes in order to survive in a new environment. Knowledge of the evolutionary process is not limited to biologists. Cattle breeders have known for generations that a fatter or healthier breed of cattle results from selective breeding. During “natural” evolution, the environment itself selectively breeds the members of a species, “choosing” which will survive and reproduce.

Functionalism

Functionalism was an early school of psychology which emphasized the instinctive origins and adaptive function of behavior. To a great extent, functionalism developed to incorporate evolutionary theory into the earlier philosophical view of human nature. The functionalists expressed various ideas concerning the mechanisms controlling human behavior. According to John Dewey (1886), for example, the reflexive survival behaviors of the lower animals have been replaced in the human being by the mind, which has evolved as the primary mechanism for human survival. The brain’s function is to enable the individual to adapt to the environment. Thus, although Dewey’s functionalism stressed the importance of survival and environmental adaptation—characteristics of Darwin’s evolutionary theory—it retained the *dualism* evident in early philosophical thought by asserting that the manner of human survival differed from that of lower animals.

In contrast to Dewey’s dualism, William James, a fellow nineteenth-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, human beings possess a larger number of instincts which guide behavior (for example, 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. William James (1890) also concluded that all instincts, both human and animal, have a mentalistic quality, possessing both purpose and direction, attributes previously accorded only to people. His is essentially a continuity theory, which, unlike Dewey’s dualism, did not demand a distinctive break between humans and lower animals.

Some psychologists (see Troland, 1928), opposed to a mentalistic concept of instinct, argued that internal biochemical forces motivate behavior in all species. This school of thought retained the similarity between humans and lower animals but substituted a mechanistic view for James’s mentalism. Energy concepts developed in physics and chemistry during the second half of the nineteenth century provided a framework for the mechanistic approach to motivation. Ernst Brücke stated in 1874 that “the living organism is a dynamic system in which the laws of chemistry and physics apply”—a view which led to great advances in physiology. These functionalists used this physiochemical approach to explain the motivation for human and animal behavior.

Psychologists advocating a mechanistic approach to instinct differed in their views of the nature of this mechanistic process. For instance, Jacques Loeb's (1899) view stressed the influence of external stimulation on behavior. Thinking that animal and human behavior was inflexible and comparable to a plant's trophism to light, he labeled his concept the *tropistic school*. According to Loeb, internal forces, such as emotions, play only a minor role in motivation. In contrast, H. S. Jennings (1904) did not believe that the animal's physiological (internal) state which produced behavior was inflexible; instead, he argued, learning could alter internal systems and thereby influence behavior. A mechanistic view has appealed to many psychologists during this century. We will see attempts to incorporate both Loeb's and Jennings's approaches during the remainder of this chapter.

A number of psychologists strongly criticized the instinct concept proposed by the functionalists on several grounds: (1) Anthropologists pointed to a variety of values, beliefs, and behaviors among different cultures whose existence rendered the idea of universal human instincts inconsistent. (2) Watson and Morgan's (1917) observations of human infants led them to conclude that only three innate emotional responses—fear, rage, and love—existed and that these could be elicited by only a small number of stimuli. (3) The widespread and uncritical use of the instinct concept did not advance our understanding of the nature of human behavior. Let's use Bernard's (1924) analysis of the instinct concept to examine the criticism prominent during the 1920s. Bernard identified several thousand, often conflicting, instincts proposed by the functionalists. One example of Bernard's was the idea that “with a glance of the eye we can estimate *instinctively* the age of a passerby” (page 132). It is not surprising that many psychologists reacted so negatively to the instinctive concept.

In the 1920s American psychology moved away from the instinct explanation of human behavior and replaced it with an emphasis on the learning process. The instinct concept reappeared in American psychology when the writings of the European animal behaviorists, called *ethologists*, who emphasized the importance of inheritance in the determination of behavior, surfaced during the 1950s. The ethological view of instinct was not readily accepted, and American psychology has only recently recognized the importance of instinctive processes in behavior. The influence of instinctive processes on learning will be examined in Chapter 10; we will now look at the theory of behaviorism, which replaced the functionalism theory in American psychology.

Behaviorism

Behaviorism is a theory which emphasizes the role of experience in governing human behavior. According to behaviorists, although we possess instinctual motives, the important determinants of our behavior are learned. Acquired drives typically motivate us, and our behavior in response to these motives is also learned through the process of our interaction with the environment. For example, a behaviorist assumes that your motivation to attend school is a

learned one and that your behaviors while you attend school are also learned. One of the behaviorists' main goals is the establishment of the laws governing learning—a concern that has dominated academic psychology for most of this century. A number of ideas contributed to the behavioral view. The Greek philosopher Aristotle's concept of the association of ideas represents one important origin of behaviorism.

Associationism Suppose that 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 association of ideas: two events can 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 from each other.

During the eighteenth century, British empiricists described the association process in greater detail. David Hume (1739) hypothesized that another factor—causal events—might be capable of association. For example, if you overslept and missed your class, your learned association might be that oversleeping causes you not to attend class.

Thorndike The work of Edward Thorndike represented another important influence on the behaviorist view. Thorndike's 1898 publication of his studies established that animal behavior could change as a consequence of experience. His ideas on learning and motivation developed from his research with his famous puzzle box (see Figure 1.1). In these studies, he placed a hungry cat into a locked box and put food outside the box. The cat could escape from the box and then obtain food by exhibiting one of a number of possible behaviors. For example, two such effective behaviors were pulling on a string and pressing a pedal. Not only did the cat escape, but also, with each successive trial, the time needed for escape slowly decreased. It appears that the cat's escape from the box progressed from a chance act to a learned behavior.

Thorndike proposed that the cat formed an association between the stimulus (the box) and the effective response. Learning, according to Thorndike, reflects the development of an S-R (stimulus-response) association. As the result of learning, when the animal reexperiences the specific stimulus, the appropriate response is elicited. Thorndike asserts 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 association developed because the cat was *rewarded*: when the cat was hungry, the appropriate response was followed by the presentation of food, which produced a satisfying state and strengthened the S-R bond. Thorndike labeled this strengthening of an association produced by pleasant events *the law of effect*.

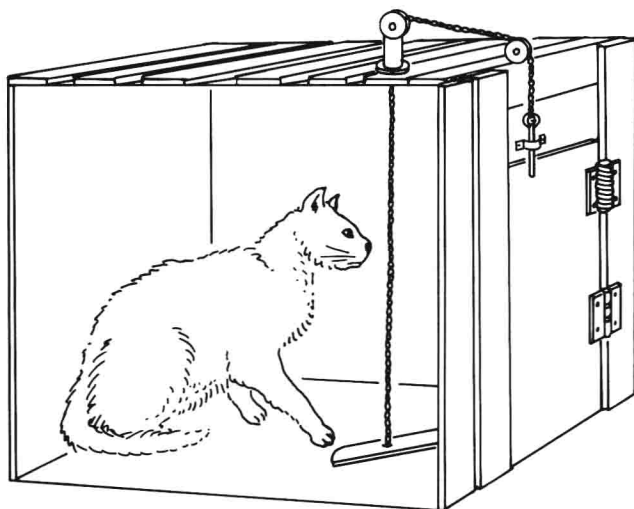


FIGURE 1.1

Thorndike's famous puzzle box: The hungry cat can escape by exhibiting one of several potential responses and thereby obtain food. From *Theories of learning* by L. C. Swenson © 1980 by Wadsworth, Inc. Reprinted by permission of the publisher.

Thorndike did not think that the law of effect represents only animal behavior; he argued that it also reflects 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. Although Thorndike initially proposed that unpleasant events weakened the S-R bond, his later studies indicated that telling subjects that they were wrong or not giving feedback about the correctness of their response did not influence his subjects' behavior. Contemporary researchers have demonstrated that aversive events often can modify both animal and human behavior. We will describe the influence of unpleasant experiences on behavior in Chapter 4.

Although Thorndike's views concerning the nature of the learning process are quite specific, his ideas on the motivational process which determines behavior seem very vague. According to Thorndike, if a particular event is satisfying, it serves as a reward; however, learning occurs or previously learned behavior is exhibited only if the animal or human is "ready." Thus in his *law of readiness* Thorndike assumes that the animal or human must be motivated to develop an association or to exhibit a previously established habit. Thorndike did not hypothesize concerning the nature of the motivation mechanism, leaving such endeavors to future psychologists. Indeed, the motivational basis of behavior became of critical concern to later generations of behaviorists.