

Stephen B. Klein

LEARNING

**Principles and
Applications**

Second Edition

LEARNING

PRINCIPLES AND APPLICATIONS

SECOND EDITION

Stephen B. Klein

Mississippi State University

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LEARNING

Principles and Applications

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PREFACE

The first edition of *Learning: Principles and Applications* was published by McGraw-Hill in 1987. One goal of this text was to provide the student with an up-to-date presentation of the current knowledge in learning and memory. [Basic principles were described and were supplemented by research studies to provide validation of those principles.] Both classic experiments and important contemporary studies were incorporated into the text.

A second aim of this text was to show the student the relevance of basic processes. This was accomplished in several ways: First, each chapter opened with a vignette. The short story gave the student an idea of the material to be presented in the chapter. Next, real-world examples of abstract concepts were provided throughout the text. The examples not only showed the operation of abstract ideas but also allowed the student to gain a better understanding of the principles being discussed. Finally, each chapter presented at least one application of these learning principles. [It is my belief that a student's knowledge of learning and memory principles is enhanced by the use of chapter-opening vignettes, real-world examples, and applications.]

This revision retains the engaging character of the first edition. The pedagogy remains a central feature of this new version, but approaches have been reworked to enhance their impact. Vignettes have been rewritten to provide a stronger focal person for each story; new real-world examples have been added involving situations relevant to student life; and applications are now more closely tied to principles and theories from which each application evolved.

Several pedagogical features have been added. Each chapter now contains section reviews, which allow the student to appreciate the main points being covered. Each review provides continuity between major discussions and guides the student to the material in the next section. The chapter-ending summaries now bring all of the main points together to enable the student to understand the central ideas presented in each chapter. There are many new terms introduced in a learn-

ing text. To ease the difficulty in incorporating and understanding the new terms, this edition contains a glossary.

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

The solid current presentation of basic principles and description of new research studies found in the first edition is retained in the revision. To this end, a major change in the second edition is the incorporation of recent research into the text. There has been much exciting new research in learning and memory in the last few years, and I have described these new ideas here.

The text 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. While there are many general laws of learning, there are also instances where 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. The text describes the research necessary to illustrate a specific learning process.

This edition contains 13 chapters. Chapter 1 gives an introduction to learning as well as a discussion of how experience can alter instinctive behavior. A brief presentation of the ethics of conducting research is included.

Chapter 2 provides a description of learning theory. The student will see the changes that 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.

Chapters 3 and 4 detail Pavlovian conditioning, a process that involves learning when events will or will not occur. Chapter 3 discusses the factors that govern the acquisition or elimination of conditioned responses. A detailed presentation of theories and applications of Pavlovian conditioning can be found in Chapter 4.

Chapters 5 and 6 describe instrumental/operant conditioning, a process that involves learning how to behave in order to obtain the positive aspects (reinforcers) and avoid the negative aspects (punishers) which exist in our environment. The variables influencing the development or extinction of appetitive or reinforcer-seeking behavior are described in Chapter 5, while Chapter 6 presents the determinants of avoidance behavior.

Chapter 7 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. Chapter 8 describes the cognitive processes that affect how and when we behave.

Chapter 9 details four cognitive learning processes and shows how we identify concepts, solve problems, make decisions, and learn to use language.

Chapters 10, 11, and 12 discuss memory, the process that allows us to retain our present experience into the future. The nature of memory storage is described in Chapter 10, while the encoding or organization of our experiences is described in Chapter 11. The processes that allow us to retrieve some experiences or forget others are detailed in Chapter 12. Further, the biological basis of memory storage and retrieval is presented in these chapters.

Chapter 13 provides a discussion of the biological processes that influence learning. In some instances, learning is enhanced by instinctive systems, while in others, learning is impaired by our biological character. Chapter 13 also describes the biological processes that provide the pleasurable aspects of reinforcement and the negative aspects of punishment.

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. I am especially grateful to Patricia Ault-Duel, Traci Belden, Jacalyn Johnson, Nancy Sellers, and Betty Stamper.

The staff at McGraw-Hill played an important role in the creation of this edition. The psychology editors, James Anker, Maria Chiappetta, and Christopher Rogers, guided the development of the text from its inception to this final product. The editing supervisor, Scott Amerman, ensured that the text was not only easy to read but also aesthetically appealing.

I also thank my colleagues who reviewed chapters of the second edition. I am especially grateful to Dr. Monnie Louise Bittle, Virginia Polytechnic Institute and State University; Dr. Michael Boivin, Spring Arbor College; Dr. Robert Gelhart, Pepperdine University; Dr. Roger Mellgren, University of Texas at Arlington; Dr. Ralph Miller, State University of New York at Binghamton; Dr. Jack Nation, Texas A&M University; and Dr. Michael Scavio, California State University, Fullerton, for their detailed and constructive comments.

My family has been very supportive of my work on this edition. I am very appreciative of their support.

Stephen B. Klein

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AN INTRODUCTION TO LEARNING

DO YOU HAVE A LIGHT?

For 2 days, Greg has resisted the urge to smoke. Having attempted to quit on more occasions than he can count, he's determined not to let his extreme nervousness and irritability keep him from succeeding this time. His family tries to distract his thoughts from cigarettes, but these attempts work only temporarily. Anticipating tonight's televised championship boxing match helped him for a while, but even this cannot prevent his recurrent, intense impulses to smoke.

Greg began smoking cigarettes when he was 15. All his friends had started the habit, so it seemed like the natural thing to do. At first, he did not enjoy smoking, for it made him cough and sometimes feel slightly nauseated. Greg smoked only with his friends and, to feel part of the group, pretended to inhale. However, as the unpleasant effects began to disappear, he learned to inhale and began to smoke more often. By the age of 18, Greg smoked two or three packs of cigarettes a day. He never thought about stopping until he met Paula. A nonsmoker, she tried to convince him to quit. Finding himself unable to break the habit, he simply did not smoke while with Paula.

After they married, Paula continued to plead with Greg to stop smoking. He has tried every now and then over the past 10 years to resist cigarettes, usually stopping for a day or two. This time had to be different. At 35, Greg thought that he was in perfect health, but a routine checkup with the family physician 2 days ago proved him wrong. Greg learned that his extremely high blood pressure made him a prime candidate for a heart attack. The doctor told Greg that the pressure could be lowered through special diet, medication, and cessation of smoking. Continued smoking would undoubtedly interfere with the other treatments. *The threat of a heart attack frightened Greg; he had seen his father*

suffer the consequences of an attack several years ago. Determined now to quit, he only hopes that he can endure his withdrawal symptoms.

Greg's intense desire to smoke, as well as his record of repeated attempts to stop, is shared by millions of people. Their addiction, stemming from dependence on the effects of cigarettes, motivates their behavior. Evidence of this dependence is the aversive withdrawal symptoms which many people experience when they attempt to stop smoking. When strong enough, the withdrawal state motivates them to resume smoking.

Cigarette smoking is just one example of addictive behavior. People become addicted to many drugs which have quite different effects. For example, the pain-inhibiting effects of heroin contrast sharply with the arousing effects of amphetamines. Although the effects of drugs may differ, the cycle of drug effects, withdrawal symptoms, and resumption of addictive behavior characterizes all addictive behaviors.

Addiction illustrates how experience affects people's behavior. In this text, we will examine the learning process, or the behavior changes that occur as a result of experience. We begin our explanation by identifying what we mean by learning.

A DEFINITION OF LEARNING

What do we mean by the term *learning*? Learning can be defined as *an experiential process resulting in a relatively permanent change in behavior that cannot be explained by temporary states, maturation, or innate response tendencies*. This definition of learning has three important components: First, learning reflects a change in the *potential* for a behavior, 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 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 see it because you cannot afford to go.

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

Third, changes in behavior can be due to processes other than learning. Our behavior can change as the result of motivation rather than learning. For example, you eat when you are hungry or study when you 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 may

have already learned to eat, and your hunger motivates your eating behavior. Likewise, you may 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. Stopping eating or studying is another instance where a temporary state rather than learning leads to a change in behavior.

Many changes in behavior reflect the result of maturational developments. For example, a young child may fear darkness, while an adult does not show an emotional reaction to being in the dark. This change in emotionality reflects a maturational process and is not 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 when 2 years old. The change in the child's behavior reflects physical growth which allows the child to reach the doorknob.

Also, behavior changes can be due to instinctive processes rather than learning. A person who experiences a painful event becomes angry and strikes out. This change in behavior reflects an instinctive reaction and is not learned.

We begin our exploration of learning by examining the nature of instinctive systems. We then will consider the simplest form of learning, which involves changes in an animal's or a person's instinctive reactions to environmental events. Later in the chapter we discuss changes in instinctive reactions that occur after an experience.

THE INSTINCTIVE BASIS OF BEHAVIOR

Konrad Lorenz (1969) suggested that instinctive systems enhance an animal's or a human's ability to adapt to the environment. Adaptation sometimes involves internal energy (or tension) aroused by a specific environmental stimulus that motivates a predetermined sequence of behaviors. In these cases, experience affects neither the eliciting stimuli nor the behavior. However, in other cases, experience can alter the eliciting environmental stimulus, the instinctive action motivated by internal tension, or both.

According to Lorenz, the ability to learn from experience and respond differentially to varied environmental circumstances is programmed into the genetic structure of a species and provides the flexibility needed to adapt to changing conditions. Sometimes experience alters the ability of environmental events to elicit behavior, the efficiency of instinctive behavior elicited by a particular stimulus, or both. Under other conditions, learning provides new eliciting stimuli, new behaviors, or both, which enhance survival. Lorenz contends that learning facilitates adaptation to the environment and that the ability to learn is innate.

The Search for Knowledge

The evolutionary process is central to an animal's or a person's capacity to adapt (see Lorenz, 1969). *Evolution* represents changes in the behavioral and physical

characteristics that a species undergoes in order to survive in a new environment. The environment contains much information, and knowledge of this information provides an animal or a person with adaptive capacity. Lorenz asserts that knowledge represents an increased sensitivity to particular aspects of the environment. A species' ability to adapt increases as, through natural selection, it incorporates knowledge about its environment into its genetic programming. According to Lorenz, evolution occurs when a species incorporates into its genetic structure the ability to absorb environmental knowledge.

The Interaction of Energy and Environment

The instinctive theory of Lorenz and his colleague Niko Tinbergen developed from years of observing animal behavior. To illustrate their model, one of Lorenz and Tinbergen's classic observations is presented, followed by their analysis of the systems controlling this observed behavior.

In 1938, Lorenz and Tinbergen reported their observations of the egg-rolling behavior of the greylag goose. This species builds a shallow nest on the ground to incubate its eggs. When an egg rolls to the side of the nest, the goose reacts by stretching toward the egg and bending its neck, so that its bill is brought toward its breast. This action causes the egg to roll to the center of the nest. If during transit the egg begins to veer to one side, the goose adjusts the position of its bill to reverse the direction of the egg. What causes the goose to react to the rolling egg? Lorenz's energy model addresses this important question.

Energy Model According to Lorenz (1950), *action-specific energy* constantly accumulates (see Figure 1-1). This accumulation of energy resembles the concept of filling a reservoir with water; the more liquid in the reservoir, the greater the internal pressure for its release. In behavioral terms, the relationship is that the greater the pressure, the more motivated the animal is to behave. The internal pressure (action-specific energy) motivates *appetitive behavior*, which enables an animal to reach an environment containing a distinctive event, a *sign stimulus*. The presence of the sign stimulus releases the accumulated energy. In terms of our example, the stretching movement and adjustment reaction are appetitive behaviors directed toward the rolling egg or sign stimulus.

The goose does not exhibit the retrieving behavior until it has reached the egg. The retrieving behavior is an example of a *fixed action pattern*, an instinctive behavior triggered by the presence of a specific environmental cue, the sign stimulus. An internal block exists for each fixed action pattern, preventing the occurrence of the behavior until the appropriate time. The animal's appetitive behavior, motivated by the buildup of action-specific energy, produces the appropriate releasing stimulus. According to Lorenz and Tinbergen, the sign stimulus acts to remove the block by stimulating an internal *innate releasing mechanism* (IRM). The IRM removes the block, thereby releasing the fixed action pattern. The sight of the egg stimulates the appropriate IRM, which triggers the retrieving response in the goose. After the greylag goose has retrieved one egg and its energy reserve