

LEARNING

BEHAVIOR AND COGNITION



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TO MY PARENTS, FRANK AND RIVA,
AND MY SON, MARK,
WHOM I LOVE VERY MUCH

PREFACE

When I was a student, I looked at my textbooks with something approaching awe. Textbooks were written by scholars, people of almost mythical wisdom and knowledge. The products of this knowledge might sometimes be boring or even incomprehensible, but I never doubted that they provided accurate and objective summaries of their areas.

Books still inspire awe in me, but with continued experience of reading others' books, and writing my own, I have come to understand that textbooks are not totally objective distillations of all knowledge. One reason is simply that there is too much knowledge to distill. In the case of learning, many thousands of books and articles are published every year, and it is not possible to adequately summarize even one year's output in a single text, much less the accumulated knowledge of decades.

In the face of this flood of information, textbook authors must inevitably be selective, and my purpose in this preface is to summarize some of the assumptions that have guided my choices. I hope that this summary will give you a useful overview of what this text will be about, its strengths, and its weaknesses.

The first choice I had to make was what areas within learning to include. Learning, after all, affects almost everything we do, from tying our shoelaces to understanding quantum physics and making friends. Although some texts try to cover all aspects of learning, I believe this approach leaves students feeling drowned in a sea of facts. I have chosen instead to concentrate on a single area within learning, namely, how we learn that certain events tend to occur together. We are continually bombarded by stimuli—thousands of lights, sounds, and odors every second—and yet from within this vast flux of experience we somehow manage to detect relationships between events that may be separated by long periods. We learn that eating certain foods later makes us ill; studying increases the chances of a good grade at the end of a course; and people

whom we help may someday help us in return. *Associative learning* is the term sometimes used to describe this type of learning because it involves detecting the relationship, or association, between events. Although we can learn associations between any events, associative learning is particularly important when the events we wish to predict are themselves important—the location of food, for example, or hostility from others. Psychologists have further divided associative learning involving important consequences into three subtypes: classical conditioning, reinforcement, and punishment. These three types will form the primary focus of this text. In considering the mechanisms involved in associative learning, however, we will also encounter research on a number of other aspects of learning, including memory, attention, and concept learning.

My choice of material within the area of associative learning was guided by several fundamental goals. The first was to present learning in a way that would be *interesting*. To this end, I have tried to present ideas clearly and have introduced extensive material on practical applications. I think one reason students sometimes find learning boring is the heavy emphasis most learning texts place on animal experiments. I strongly believe in the value of such research, but students have understandable difficulty in seeing the relevance of research on rats in a Skinner box to the problems they face in their daily lives. It is not enough to assert this relevance; it has to be demonstrated, and I have tried to do this by interweaving material on laboratory research and practical applications throughout the text. Applying learning principles to real life is not only a legitimate focus of interest in its own right but it is also a critical test of the validity of those principles: By observing where applications fail, we gain important information about the limitations of our knowledge.

My second goal was to present ideas in a way that would be intellectually *rigorous* and *stimulating*. One of the most difficult issues in planning any text is how to balance the need for broad coverage against the dangers of superficiality and of losing students in a forest of facts. My own bias is against the handbook approach. I think students gain more from a deep understanding of fundamental ideas than from a superficial familiarity with a much larger set of facts. In writing this text, therefore, I have tried to identify the most important issues in associative learning and present them in depth, rather than providing shallower coverage of all concepts.

One example of this approach is in my treatment of experimental design. It is important that students understand the logic of experiments rather than just memorize their conclusions, so I have emphasized the logic of experimental analysis throughout this text. Chapter 1 provides an introduction to the experimental method—what are the advantages and disadvantages of experiments, why do learning researchers sometimes use animals, and so on. In subsequent chapters, I have continued this approach by analyzing selected experi-

ments and methodological issues in depth, while giving briefer summaries of other studies.

I have taken a similar approach to presenting theories, concentrating on a few rather than describing them all. In the case of classical conditioning, for example, I have focused on the theory I consider to be the most important: the Rescorla–Wagner model. Through extensive analysis of this model, I have tried to convey a feeling for how theories are constructed and how they can be used to explain known phenomena and to generate novel and sometimes counter-intuitive predictions. To illustrate how competing theories can be evaluated, I have devoted an entire chapter to tracing the conflict between associative and cognitive theories of learning. Chapter 9 explores the assumptions of these theories, how they have been tested, and how these tests have guided the evolution of the theories. Where this selective approach has meant that coverage of some issues has had to be curtailed, I have provided references that the interested reader can consult for more information.

A third distinctive characteristic of this text is its strong emphasis on the *role of cognitive processes* in associative learning. For many years, conditioning was viewed as a fundamentally simple process, based on the formation of associations between contiguous events. More recently, there has been increasing recognition of the importance of cognitive processes such as memory and attention in the formation of even the simplest association. Most textbooks, however, have treated research on conditioning and cognition in chapters that are separated not only physically but also conceptually. This approach leaves the impression that the brain is composed of isolated boxes, one labeled associative learning, another memory, and so on. There is little indication of how these processes interact as components of a unified system for gathering and interpreting information.

I have tried to emphasize the interactions between conditioning and cognition. Chapter 10 introduces the concepts of information processing and uses these concepts as a framework for systematically exploring the role of memory and attention in the formation of associations. Chapter 11 then examines the relationship between conditioning and more complex forms of learning. For example, there is evidence that animals form complex cognitive maps of their environment and that they can use complex rules and concepts to solve problems. One possibility is that the processes underlying these complex forms of learning are far more sophisticated than those involved in conditioning. However, a recently developed model suggests that all forms of learning involve the same fundamental mechanisms. This new approach is based on the structure of neural networks in the brain, and it has already had impressive success in accounting for instances of learning ranging from classical conditioning in garden slugs to language learning in humans. The text concludes with an examination

of this neural network model and its potentially revolutionary implications for our understanding of learning.

I hope that you will find this text challenging and interesting and that it will give you some sense of the importance and excitement of recent research in learning. If the text achieves any of these aims, credit will be due to many individuals. One is Ralph Haber, who provided warm encouragement and support when I first contemplated what to me was the awesome prospect of writing a text. I am also grateful to many friends and colleagues who have read and commented on the manuscript at various stages of its preparation. Tony Dickinson of Cambridge University, Vin LoLordo of Dalhousie University, and Glyn Thomas of Birmingham University were all kind enough to read the entire manuscript. I am also grateful to Pete Badia of Bowling Green State University, David L. Brodigan of Carleton College, John Capaldi of Purdue University, Alexis C. Collier of Ohio State University, Robert L. Greene of Case Western Reserve University, Nancy K. Innis of the University of Western Ontario, Donald F. Kendrick of Middle Tennessee State University, Steve Maier of the University of Colorado, Mary Jane Rains of the University of Wisconsin, Stout, and Mark Rilling of Michigan State University. I believe the text benefited substantially from the comments of all of these reviewers, and I am grateful for their efforts. I did not always follow their advice, however, and accordingly, they should not be held responsible for any errors or omissions that remain.

I would also like to thank the production staff at Wadsworth. It perhaps reveals my naiveté, but I have been surprised and impressed by the helpfulness and dedication of all the staff with whom I have worked. I particularly want to thank Gary McDonald and Angela Mann, production editors, Robin Kelly, copy editor, and Stacey Pollard, assistant editor. It has been a pleasure working with all of you.

Perhaps my greatest debt, though, is to Ken King, the psychology editor at Wadsworth. I find it difficult to convey how much he has contributed. From the beginning, he understood what I was trying to do and strongly supported me in working to achieve it, even in cases where this posed a potentially serious risk to the commercial attractiveness of the finished product. I am grateful for his support, encouragement, and acute insights; I do not think I could have had a better editor.

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