LEARNING

BEHAVIOR AND COGNITION

SECOND EDITION

DAVID A. LIEBERMAN

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BEHAVIOR AND COGNITION

Second Edition

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PREFACE

I find research on learning exciting. The topic is of profound importance—almost every aspect of our behavior is guided by learning—and there can be wonderful pleasure when researchers' efforts to penetrate the complex and tangled surface of human behavior yield glimpses of the elegant processes lying underneath. Tackling learning may not be quite as physically stimulating as trying to climb Everest, but the intellectual challenge is every bit as exhilarating.

In writing this text, I have tried to communicate the challenge facing learning researchers, and the excitement and beauty of their voyages of discovery. The purpose of this preface is to explain some of the assumptions that guided my efforts and also some of the features of the resulting text that perhaps make it distinctive.

Intellectual stimulation. One of my fundamental goals was to present ideas in a way that would be intellectually *rigorous* and *stimulating*. In planning any text, one of the most difficult issues is how to balance the need for broad coverage against the dangers of superficiality—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 issues.

One example of this approach is in my treatment of experimental design. If students are to be helped to think critically, it is vital that they understand the logic of experiments, rather than just memorize their conclusions. For this reason, 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 experiments and methodological issues in depth, while giving briefer summaries of other studies.

I have taken a similar approach to presenting theories, concentrating on presenting a small number in depth rather than providing more superficial coverage of 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 can be used to explain known phenomena and to generate novel and sometimes counterintuitive predictions. This material is not easy, but I have tried to present the material as clearly and as simply as I could, and in my experience students feel that the model's importance makes the effort it requires worthwhile.

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.

Practical applications. A second goal was to present learning in a way that would be *interesting*. I think students sometimes find learning boring because of an understandable difficulty in seeing the relevance of experiments on rats to the problems they face in their daily lives. It is not enough for teachers and textbooks to assert that laboratory research is relevant: This relevance has to be demonstrated. I have done this by interweaving material on laboratory research and practical applications throughout the text. Applications of learning principles are not only fascinating in themselves but also provide a critical test of the validity of laboratory principles. Material on applications thus provides a sense not only of how much has already been achieved but of what remains to be discovered.

Among the practical issues examined in the text are how rewards and punishments subtly shape our lives (why is it, for example, that students often have so much difficulty in forcing themselves to study, when there appear to be such massive rewards contingent on good grades—entrance to graduate school, a good job, and so on); how classical conditioning affects emotions such as fear and sexual arousal; how learning principles can be used to overcome phobias and cigarette smoking; but also the need for caution in applying learning principles (for example, how rewards for doing homework can sometimes reduce interest in studying rather than enhance it).

The conflict between associative and cognitive theories of learning. Perhaps the single most important factor shaping the development of research on learning has been the tension between associative and cognitive interpretations. Where associative theorists believe that complex learning can be understood in terms of fundamentally simple associative mechanisms (in Estes' classic phrase, learning is viewed as a sort of mental chemistry), cognitive theorists assume that the fundamental processes are much richer and more complex.

Given the central role of the conflict between these views in the develop-

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ment of the field, I have devoted considerable space to explaining the two views and tracing their evolution under the pressure of accumulating evidence. The alternative conceptualizations are first introduced in Chapter 2, and then analyzed more intensively in Chapter 11, which describes the conflict between S-R and cognitive theories of what is learned, and how the views of the two sides gradually converged. The chapter concludes by exploring the possibility that both sides may have been right, as learning may involve both relatively simple habits and more complex expectations. (This view has recently found powerful echoes in research on human cognition, with the emergence of distinctions between controlled and automatic processes, and between procedural and declarative memories.)

Chapter 12 then traces the development of information-processing models of learning, and examines how principles of memory and attention developed in research on human cognition can also be used to explain many aspects of associative learning. This approach represents a synthesis of cognitive and associative approaches to learning: The emphasis on explanatory processes such as memory and attention is clearly cognitive, but the models retain the assumption of associative theories that seemingly complex phenomena can be understood in terms of simple underlying processes.

Finally, Chapter 13 introduces one of the most exciting recent developments in psychology, *neural network models*. These models provide a new synthesis of associative and cognitive approaches: Learning is still seen as involving cognitive processes of considerable complexity, but these are in turn explained in terms of simple associative processes at a neural level. In the few short years since these models first appeared, they have already had impressive success in accounting for instances of learning ranging from classical conditioning in slugs to language learning in humans. The chapter examines some of this evidence, and considers the potentially revolutionary implications of neural network models for our understanding of learning and the mind.

Key changes to the second edition. The second edition involves many changes designed to improve existing material or incorporate new material (an expanded section on the conditioning of autonomic responses to insulin, heroin, and viruses is one example). The largest of these changes involves greatly expanded coverage of the biological bases of learning. Animals and humans do not start life with totally blank minds—John Locke's famous *tabula rasa*. Many thousands of years of evolution have endowed us with built-in reactions to important events, and learning occurs within the boundaries of this biological inheritance. In this edition, I have given greater emphasis to this biological context, and Chapter 10 has been entirely devoted to the role of evolution in shaping learning. The chapter begins with an introduction to the concepts of evolution, and it then traces how the pressures of natural selection have molded learning processes to fit the needs of different species and situations.

Imprinting and song-learning are used to illustrate the diversity of learning, along with examples from classical conditioning and reinforcement. It is now abundantly clear that the general process view of learning is wrong—learning is not uniform in all species and situations—but the chapter concludes by exploring the possibility that the observable differences in learning may represent variations on a small number of common themes.

Aids to studying. In order to help readers to absorb the sometimes challenging material in each chapter, an extensive *Summary* is provided at the end of each chapter. In addition, there is a *Selected Definition* section that reviews the main concepts introduced in the chapter, and a series of *Review Questions*. If a student can answer these questions, he or she can be confident that they have understood the main concepts and themes of the chapter.

Acknowledgments. I hope that this text is both challenging and interesting, and that it provides a sense of the importance and excitement of research on 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. For the first edition, 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 also received helpful comments from 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.

In preparing the second edition, I was helped by comments from Pamela Jackson-Smith of the University of Utah, Michael E. Rashotte of Florida State University, and Gene D. Steinhauer of California State University at Hayward, who read the first edition and offered suggestions for how it could be improved. Bill McGrew and Cliff Henty of the University of Stirling then provided helpful comments during the preparation of Chapter 10, and Michael S. Fanselow of the University of California at Los Angeles and Sandra J. Kelley of the University of South Carolina at Columbia, were both kind enough to comment on the entire revision.

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.

In a slightly different context, I am again grateful to Mike Rashotte of Florida State University. I prepared a considerably expanded Test Manual to accompany this edition, and Mike was kind enough to allow me to incorporate some of the exam questions he used in his course in the Manual.

I would also like to thank the production staff at Wadsworth, as well as Peggy Tropp, who acted as copy editor, and Cecile Joyner of the Cooper Company who was a very helpful production 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. From the beginning, he understood what I was trying to do and strongly supported me in working to achieve it, even in cases such as the Rescorla-Wagner model, where my approach differed substantially from that of existing texts. 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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