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Learning and Memory

Second Edition

The first text to integrate behavioral and cognitive approaches to learning and memory, this engaging textbook emphasizes human research, reflecting the field's evolution. *Learning and Memory* also recognizes the vital contribution of animal research, covering all historically important studies. Written in a lively and conversational style, this second edition encourages students to think critically. One example is its exploration of the Rescorla-Wagner model, the most important theory of conditioning, now further streamlined to improve student comprehension. Another is the addition of critical-thinking questions, which encourage students to evaluate their reactions to the material they've read, and relate findings to their own lives. Research includes an emphasis on practical applications such as treatments for phobias, addictions, and autism; the arguments for and against corporal punishment; whether recovered memories and eyewitness testimony should be believed; and effective techniques for studying. The text concludes with an overview of neural networks and deep learning.

David A. Lieberman was an undergraduate at Columbia University and received his Ph.D. from Brown University. He taught for four years at the University of Illinois, Champaign-Urbana, where he was twice selected as the 'most stimulating' teacher in psychology in university polls of graduating seniors. He then moved to the University of Stirling in Scotland where his course on learning received the highest student ratings of any course in psychology. He served two terms as Associate Editor of the Quarterly Journal of Experimental Psychology and was one of only two psychology members of the SERC panel – the UK equivalent of the US National Science Foundation – that awarded research grants in psychology. He is the author of *Learning and the Control of Behavior*, *Learning: Behavior and Cognition*, and *Learning and Memory*.

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For Nick, Nat, and Myra, and my grandchildren Anton, Rory, and Eli

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Preface

Several goals guided me in writing this text. Briefly, I wanted it to be ***stimulating and enjoyable***.

Stimulating

One of my fundamental goals was to present ideas in a way that would be intellectually stimulating. All textbook authors face the problem of 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 to lean toward depth rather than breadth: I think students gain more from a deeper understanding of fundamental ideas than from a superficial familiarity with a much larger set of facts.

The experimental method: To encourage this understanding, the first chapter provides an in-depth introduction to the experimental method. Subsequent chapters build on this foundation by analyzing the logic of key experiments, exploring how the use of control groups allows the elimination of alternative explanations.

Theories: I have taken a similar approach to theories, concentrating on a small number so that students can really understand them. One example comes in the section on conditioning, where I focus on the Rescorla–Wagner model. Another comes in the final chapter, which is entirely devoted to neural network models, exploring their potential to explain behavior ranging from classical conditioning in slugs to language learning in humans. By introducing the assumptions of these models gradually and clearly, I've tried to show how theories can be used not only to explain known phenomena but to generate powerful and sometimes surprising predictions.

Understanding these models requires effort, but:

1 I think they will prove two of the most important theories in the history of psychology. The Rescorla–Wagner model, for example, is almost universally regarded as the single most important theory of conditioning ever proposed; with a few simple assumptions (once you understand them), it can explain a remarkable range of phenemona, and it makes predictions that at first seem impossible but turn out to be right. Even if students don't understand every single aspect, they can emerge with renewed respect – and, for some, excitement – over the power of theories, and of psychology.

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2 For this edition, I've further simplified the discussion of the Rescorla–Wagner model by reducing the number of equations. Reviewers have been enthusiastic. One wrote "This section is EXCELLENT! Frankly, I think this might be one of the better expositions of the topic that I've seen." Another said "I love the re-write. Clean, clear and much more digestible for an undergraduate course." And a third, "the presentation of the Rescorla–Wagner model is excellent."
3 There will still be courses where these sections aren't appropriate, and both can be omitted without damaging understanding of other sections. To make this easier, I've moved the Rescorla–Wagner model to the end of the chapter on theories of conditioning, and similarly discussion of neural networks comes at the end of the final chapter.

Enjoyable

No matter how stimulating ideas may be in principle, they will not have this effect in practice unless readers understand them and find them interesting. I have tried very hard, therefore, to present ideas clearly and, where possible, entertainingly. I hope reading the text will feel more like participating in an enjoyable conversation than listening to a formal lecture.

Applications: One way to make ideas come alive is to explore their practical implications, and I have tried to do this throughout the text. Students sometimes find research on learning boring because of an understandable disinclination to believe that experiments on rats can shed much light on human behavior, and similar problems can arise in seeing the value of memorizing nonsense syllables or paired associates. 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 in every chapter. The chapters on classical conditioning, for example, discuss the role of conditioning in phobias and drug cravings, and how conditioning principles have been used to treat them. Similarly, the chapters on reinforcement look at applications such as Lovaas's stunningly effective treatment for autism, and whether reinforcement undermines intrinsic motivation.

The chapters on memory continue this emphasis. Applications covered include techniques for improving studying, the accuracy of eyewitness testimony, and the painful issue of whether recovered memories of childhood abuse should be believed.

Human research: A related feature of the text is its emphasis on human research. This does not mean ignoring animal research. Especially for conditioning, animal research has provided the foundation for our understanding – and is also where I spent most of my career – and all important animal research is covered. However,

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my goal has not been to present a thorough picture of how rats and pigeons learn, but wherever possible to introduce principles through human research, and then explore how these principles have been practically applied.

Students enjoy this research, and it also provides a crucial test of whether the principles developed in animal laboratories apply to people. Sometimes human research confirms findings from animals, sometimes it points us in important new directions. As one example of my synthesis of the two areas, I think this may be the only text that, in considering how reinforcement influences our behavior, discusses both animal research on the matching law and Kahneman and Tversky's research on heuristics.

Aids to Studying

To help readers absorb the sometimes challenging material in each chapter, I have provided Summaries at the end. In addition, each chapter contains Review Questions and Critical Thinking questions designed to encourage students to think more deeply about the material. There are also two sections – in the introductory chapter and then again in Chapter 13 on applications – summarizing the most effective techniques for studying.

Changes from the First Edition

Every section of the text has been updated, but some of the more substantial revisions include:

- Discussion of the **Rescorla–Wagner model** has been simplified by reducing the number of equations. I've also moved it to the end of the chapter on theories of conditioning, to make it easier for instructors to omit it.
- Major changes to the final chapter on **neural network models**. The chapter now begins with a discussion of how the brain controls every aspect of our behavior. It then discusses the neural processes involved, and how these neurons are connected in networks. The final section now incorporates extensive material on the astonishing successes of the most recent version of neural network models, **deep learning**.
- **Theories of reinforcement**: The discussion of heuristics has been reorganized; there is also a new section on the **matching law.**
- **Classical conditioning**: A substantially revised discussion of what behaviors can be conditioned.
- **Motor learning**: A major new section in Chapter 8.

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- **Memory systems**: Chapter 10 has been revised to make the relationship between different memory systems clearer.
- **Habituation**: A new section.
- **Critical thinking questions:** Most chapters now include critical thinking questions, designed to encourage students to think more deeply about the issues raised, and to relate them to their own lives.

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