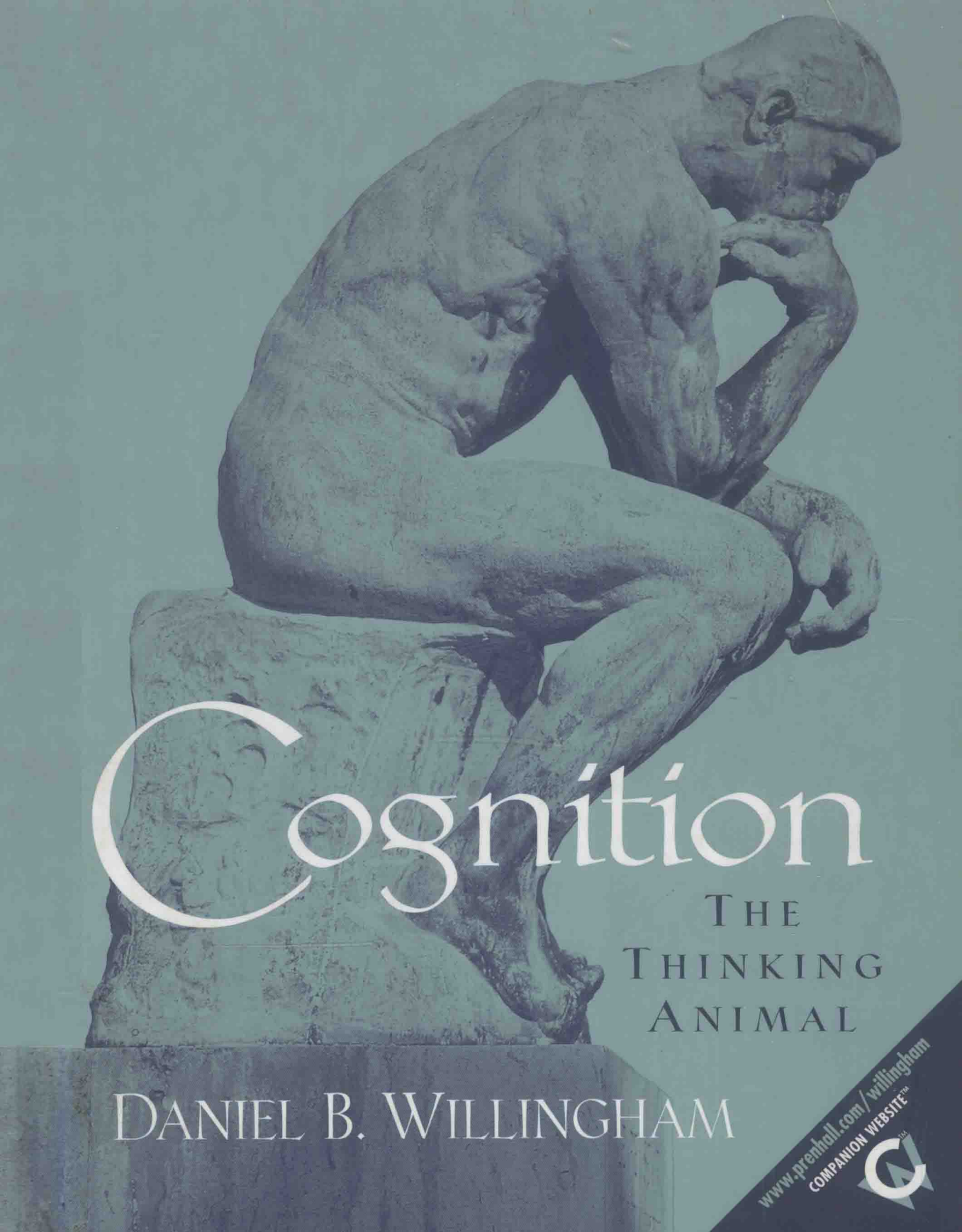

Cognition

THE THINKING ANIMAL

DANIEL B. WILLINGHAM

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Cognition

The Thinking Animal

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This book is dedicated
to my parents

Cognition

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PREFACE

A long-standing goal of human enquiry is to understand ourselves. How can we characterize the human species? Here are some of the better-known proposals:

Man is by nature a political animal—Aristotle
Man is a noble animal—Sir Thomas Browne
Man is a tool-using animal—Thomas Carlyle
Man is a reasoning animal—Seneca
Man is a social animal—Benedict Spinoza
Man is a rational animal who always loses his temper when he is called upon to act in accordance with the dictates of reason—Oscar Wilde.

I would propose that all of these proposals are, in a sense, correct, but they are all rooted in another characteristic. We are able to act politically, to use tools effectively, to understand nobility, etc., because of our ability to think. The heart of the matter is that we are thinking animals, and it is thinking that affords these other abilities or, at least, affords our having these abilities in the manner that we do. The book you are reading is a study of cognition—of how humans think.

This book is intended for students taking their first course in cognitive psychology. No background knowledge in psychology or statistics is presupposed. As is typical of other books designed for such a course, the book is organized around the major subject areas of cognitive psychology, and most of the book can be covered over the course of a semester. Again, as is typical of cognitive psychology textbooks, the coverage begins at what may be loosely thought of as lower-level processes, and proceeds toward higher-level processes.

There are three things I would like you to know about this book: what I have done regarding it's readability, what I have done regarding pedagogy, and how I have handled the inclusion of material from cognitive neuroscience.

➤ READABILITY

I have friends throughout the country who teach introductory cognitive psychology at their college or university. None of them ever says something like, "My students are crowding office hours, calling me at home, and filling my email in-box demanding to know more, more, more cognitive psychology! They love it like a mouse loves cheese!" The comments of my friends usually run

more along the lines of, "They hate the subject matter, hate the course, hate the book, hate me."

Why? I don't know, but it has been the guiding force in my writing this book. *My goal is to have a class full of students who have done the assigned reading, and who are excited by cognitive psychology.* The way to do that, I think, is to communicate what makes cognitive psychology interesting. To be honest, I've never cared much for the way that other textbooks have sought to keep students interested. The usual strategy is to include lots of "real world" examples and lots of demonstrations, usually found in little boxes that appear every few pages. This strategy seems to confirm the reader's growing suspicion that they are bored by sending the implicit message, "Yes, yes, I know this stuff is boring, but hang in there, and every few pages I'll toss in one of those boxes with a demonstration or real-world application to keep you going."

I've done three things in this book to try to arouse the reader's interest in the material:

1. I have tried to be careful about making the questions that motivate cognitive psychologists explicit. I think the questions we ask are of interest to a lot of people, but we don't always do the best job of explaining the questions in any detail. We plunge right into the answers, and the answers seem arcane and removed from anything anyone would care about. Each chapter in this book is organized around two or three straightforward questions that are easy to appreciate, and the importance of which are explained in detail.
2. To the extent possible, I have used a narrative structure. By that I mean that there are causal links within and across chapter sections, so that it makes it more clear *why* you are reading something. Nothing is more boring than a list of unconnected facts.
3. I have tried to write in a non-stilted, not-especially-academic style.

Despite the light tone, this book is not light in content. As you can see by flipping through any given chapter, I cover the major topics in each sub-area of the field. (An easy way to check the coverage is by examining the "key terms" section at the end of each chapter.) Included in the coverage of almost all of these topics are significant details from landmark experiments, including the methodology, graphs of results, and so on. Again, a lighter tone should not be interpreted as indicating lighter coverage.

➤ PEDAGOGY

Readability is fine, but the goal of a textbook is, after all, that students learn the material. Different students like and use different pedagogical features, so I've included a few different ones to help them learn.

- Brief **previews** of each section pose the broad questions and provide the broad answers contained in the section.

- **Key terms** are identified by bold-face type, and are defined immediately thereafter. They are also collected in a glossary.
- Each section closes with a series of questions. The **Stand-on-one-foot summary questions** simply ask the student to summarize what they have learned in the section they have just read. I call them stand-on-one-foot-summaries after the talmudic story of the heretic who went to great sages, asking each to summarize all of the Torah in the time that he could stand on one foot. (He finally found a willing sage in Hillel who quoted from Leviticus, "What is hateful to you, do not to others.") Thus, the idea is simply to get the reader to pause for a moment and make sure they understood the major points by summarizing what they have just read.
- The end of each section also includes questions that require considerably more thought; the student will need to apply what he or she has just learned to new situations, or to go beyond the material in some way. I call these **Questions that require two feet.** Answers to all questions are provided at the close of each chapter.
- There is a companion web site http://www.prenhall.com/willingham to accompany the text, authored by Robert Bramucci of the California State University, Fullerton. The web site includes an online study guide for students (lots of self-test questions in different formats), a recap and summary of each chapter, links to relevant sites on the internet, and more.

Another feature of this book that I think students and professors will find useful is the Appendix. This book assumes no background knowledge on the part of the student, but an appreciation of the work in cognitive psychology often requires knowledge of statistical or methodological concepts. The Appendix contains background information and explanations of several concepts (e.g., statistical significance) that may be familiar to a student who has taken other psychology courses, but that a beginning student may not know. In order to maintain the flow of the book, these explanations are collected in the Appendix.

➤ *The Brain*

There is no doubt that the influence of neuroscience on cognitive psychology is substantial, and it is increasing. This trend poses a problem for the writers of textbooks, and the teachers of cognitive psychology courses. Cognitive neuroscience can easily fill a semester-long course, and indeed, there are stand-alone texts on the subject. Further, discussion of this work presupposes some background in neuroscience. How, then, to fairly represent the impact of cognitive neuroscience on cognitive psychology without making the course twice as long, and without setting another prerequisite for the students?

I have tried to represent the state of the field, including key findings from cognitive neuroscience, and at the same time to give the instructor some flexibility. The chapters of this book make reference to key neuroscientific studies where appropriate; there are certain findings that have had such an impact on

cognitive psychology that they simply must be part of any course. I have tried to describe these findings in a way that assumes no background on the part of the student.

For the instructor who prefers a greater emphasis on cognitive neuroscience, I have included additional materials. The "Brain Interlude" that follows Chapter 1 introduces the student to the rationale behind cognitive neuroscientific studies, the methods they use, and a brief introduction to brain anatomy. Throughout the rest of the book, key studies from cognitive neuroscience are discussed in boxes set off from the main text. These experiments were selected with an eye towards exposing students to a variety of methods and some of the key issues in cognitive neuroscience. Those instructors who place less emphasis on cognitive neuroscientific approaches can, of course, instruct students to simply skip over this material.

I hope that I have written a textbook that will make students enthusiastic about this field, and will make them want to know more than they can find in this book. Hillel's answer to the impatient heretic is not always quoted in full; after providing the summary of the Torah, Hillel added, "Now go and study," acknowledging that a one-sentence summary was bound to be lacking, and that the heretic should learn more. I have not succeeded in summarizing cognitive psychology in a sentence, but I can add the entreaty; I hope that this book will serve as a starting point from which students will want to learn still more about the field.

I would greatly appreciate feedback and suggestions regarding this text. It is easiest to reach me via electronic mail: willingham@virginia.edu

➤ *Acknowledgments*

Discovering what you do not know and the extent to which you must lean on others when writing a textbook is a humbling experience. This humility comes into sharp focus when writing acknowledgments. I have had to resist the urge to catalogue the many persons who were of assistance ("Mad love and a big shout-out to that guy who gave me a dime for the Xerox machine in the library!") and will try limit my thanks to those people whose contributions were quite direct.

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I also offer sincere thanks to my colleagues who reviewed earlier versions of chapters: Thomas R. Alley, Clemson University; Terri Bonebright, De Pauw University; Linda S. Buyer, Governor's State University; Stephen Christman, University of Toledo; Jane Marie Clipman, Lafayette College; Peter Derks, The College of William and Mary; Bob Ferguson, Buena Vista University; Diana Heise, Millsaps College; Richard L. Marsh, University of Georgia; Danielle McNamara, Old Dominion University; Kristy A. Nielson, Marquette University; and Marilyn L. Turner, Wichita State University. Their thoughtful, careful reviews led to substantial changes in the format and the details of the book. I have reviewed textbooks for publishers and can attest to the fact that no one does it for the honorarium; it is a service to the field, and I greatly appreciate it.

I have had the remarkable good fortune to learn from and work with some great cognitive psychologists, all of whom are also gentle, warm-hearted people. My thanks to my graduate school advisors—Bill Estes, Steve Kosslyn, and Mary Jo Nissen—who were so generous with their time and wisdom. John Gabrieli has also been an enduring influence as a colleague and friend. I'm also grateful to my cognitive colleagues at the University of Virginia—Michael Kubovy, Denny Proffitt, Tim Salthouse, and Bobbie Spellman—for their helpfulness with particular questions, for their encouragement in all matters, and for making it fun to come to work.

Finally, my special thanks to my parents, who have been patient and supportive guides throughout my life. I dedicate this book to them, for the advices.

Daniel B. Willingham
University of Virginia

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