

# COGNITIVE PSYCHOLOGY

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THIRD EDITION

ROBERT J. STERNBERG

EDITION

3

# Cognitive Psychology

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**Robert J. Sternberg**

*Yale University*

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*This book is dedicated to my three principal  
advisors, mentors, and role models:*

*Endel Tulving, during my undergraduate years at Yale*

*Gordon Bower, during my graduate years at Stanford*

*Wendell Garner, during my junior-faculty years back at Yale*



# About the Author

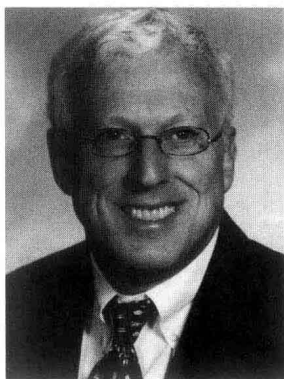
## ROBERT J. STERNBERG

Robert J. Sternberg is IBM Professor of Psychology and Education and the Director of the Center for the Psychology of Abilities, Competencies, and Expertise at Yale. The Center is dedicated to the encouragement of theory, research, practice, and policy advancing the notion of intelligence as developing expertise—as a construct that is modifiable and capable, to some extent, of development throughout the life span. The center seeks to have an impact on science, on education, and on society.

Sternberg received the Ph.D. from Stanford University in 1975 and the B.A. *summa cum laude*, Phi Beta Kappa, from Yale University in 1972. He also holds honorary doctorates from the Complutense University of Madrid, Spain; the University of Leuven, Belgium; the University of Cyprus; and the University of Paris V, France.

Sternberg is the author of more than 900 journal articles, book chapters, and books, and he has received more than \$16 million in government and other grants and contracts for his research. The central focus of his research is on intelligence, creativity, and wisdom, and he also has studied love and close relationships as well as hate. This research has been conducted on five different continents.

Sternberg is president-elect of the American Psychological Association. He is also a fellow of the American Academy of Arts and Sciences, the American Association for the Advancement of Science, the American Psychological Association (in 14 divisions), the Society of Experimental Psychologists, and the American Psychological Society. He has won many awards from the American Psychological Association (APA), the American Educational Research Association (AERA), the American Psychological Society (APS), and other orga-



nizations. These awards include the Early Career Award, E. L. Thorndike Award for Career Achievement in Educational Psychology, and Boyd R. McCandless Award from APA; the Palmer O. Johnson, Research Review, Outstanding Book, and Sylvia Scribner Awards from AERA; the James McKeen Cattell Award from APS; the Distinguished Lifetime Contribution to Psychology Award from the Connecticut Psychological Association; the International Award of the Association of Por-

tuguese Psychologists; the Cattell Award of the Society for Multivariate Experimental Psychology; the Award for Excellence of the Mensa Education and Research Foundation; the Distinction of Honor SEK from the Institution SEK (Madrid); the Sidney Siegel Memorial Award of Stanford University; and the Wohlenberg Prize of Yale University. He has held a Guggenheim Fellowship, and Yale University Senior and Junior Faculty Fellowships as well as an National Science Foundation (NSF) Graduate Fellowship. He also has held the Honored Visitor Fellowship of the Taiwan National Science Council and the Sir Edward Youde Memorial Visiting Professorship of the City University of Hong Kong. He has been listed in the *Esquire* Register of outstanding men and women under 40 and was listed as one of 100 top young scientists by *Science Digest*. He has been president of the Divisions of General Psychology, Educational Psychology, Psychology and the Arts, and Theoretical and Philosophical Psychology of the APA and has served as Editor of the *Psychological Bulletin* and is Editor of *Contemporary Psychology*. Sternberg is most well known for his theory of successful intelligence, his investment theory of creativity (developed with Todd Lubart), his theory of thinking styles as mental self-government, balance theory of wisdom, and his triangular theory of love and theory of love as a story.

# To the Instructor

Every year it was a gamble, and every year I lost: I had taught cognitive psychology a number of times during my 20 years at Yale, and I had never used the same textbook twice. For whatever reason, my students were never taken with any of the books I chose and neither was I. The book was too hard or too easy; too narrow or too broad, too dated or too trendy. They were decent books, just not the right books. Finally, I decided to stack the deck and write the book myself. In this preface, I describe my goals for both the third edition and for the original text in particular.

## What's New in the Third Edition?

### **Brief Description of This Book's Overall Philosophy**

This book is intended to provide comprehensive coverage for a course on cognitive psychology (or cognition). The book seeks to cover “lab to life.” It covers theory, lab and field research, and applications to everyday life. Critical-thinking questions help students think about the material.

The third edition of *Cognitive Psychology* has been updated in a number of different ways. The total number of changes is too great to mention all of them. Here are the main changes from the second edition:

1. *Very extensive updating.* The field of cognitive psychology is developing at breakneck speed. You will find hundreds of new references in the Third Edition.
2. *“In the Lab of...” boxes.* When they read psychology textbooks, students often do not get a sense of what the research enterprise really is like. Getting such a sense is especially important in cognitive psychology, because the field is largely a lab-based science. Each chapter in the third edition has an “In the Lab of...” box that showcases the research of a major cognitive psychologist in his or her own words.
3. *CogLab.* Many instructors wish for students in their cognitive psychology courses to have lab experience. The Wadsworth CogLab provides such opportunities, and is keyed to the chapters in this text.

In addition, a number of specific changes have been made in individual chapters.

1. Addition of “Key Themes in Cognitive Psychology” in Introduction to Cognitive Psychology (Chapter 1). These themes are then continued throughout the book

2. Major revision of Cognitive Neuroscience (Chapter 2) in response to referees' comments that it overlapped too much with introductory texts—most material below the level of the brain has been deleted, making the chapter more manageable in size and scope
3. Organization of theories in cognitive-neuroscientific approaches to attention and consciousness by ideas rather than investigators in Attention and Consciousness (Chapter 3)
4. Deletion of material on Spatiotemporal Boundary-Formation Theory, which reviewers found too esoteric, from Perception (Chapter 4)
5. Addition of new component in Baddeley's theory of working memory, as proposed in his 2000 article, and new material on testing for Alzheimer's disease, in Memory: Models and Research Methods (Chapter 5)
6. Reduction of material on memory scanning, and addition of new material on eyewitness testimony in Memory Processes (Chapter 6)
7. Reorganization of language acquisition section and some additional material on metacognition in Language: Nature and Acquisition (Chapter 9)
8. Transfer of material on reading from Perception chapter to Language in Context (Chapter 10), added discussion of violation of conversational postulates, enhanced discussion of second-language learning, enhanced coverage of cognitive neuroscience of language
9. Added discussion of Simonton's work on creativity, work on evolutionary theories of creativity, types of creativity, and surface- versus deep-structural processing to Problem Solving and Creativity (Chapter 11)
10. Deletion of material in Decision Making and Reasoning (Chapter 12) on truth tables, which referees thought was too difficult for students
11. Added material on theory of mind, on DeLoaches's work, and on how children influence their environment to Cognitive Development (Chapter 13)
12. Pruned old AI material, added material on working memory and intelligence, added material on emotional intelligence, added material on brain size and intelligence to Intelligence (Chapter 14)

## The Original Goals of This Book

When I first undertook to write this textbook, I knew what I wanted in a textbook, and I knew what my students wanted; or at least I thought I did. We wanted a book that would achieve a number of objectives.

1. *Combine readability with integrity.* I have chosen books that were so chewy that only the strongest stomachs could digest their contents, and I have chosen ones that melted like cotton candy, with substance to match. I have tried to write a book that would give students something to chew on, but one that they could easily digest.

2. *Balance a clear presentation of the big questions of cognitive psychology with a respect for the important details of the field.* Perhaps in no course more than in cognitive psychology are both the forest and the trees important. The best and most lasting work in the field is driven by enduring and fundamental questions. However, that work also respects the details of methods and data analysis needed to produce meaningful results. In order to achieve the balance, I have opened each chapter with a preview of the big questions dealt with in that chapter and ended each chapter with a summary of what we have learned in the field that addresses each question. Within the chapters, the writing has been guided by the big questions, while conveying to students the kinds of details to which cognitive psychologists need to attend in both their theory and research.
3. *Balance the learning of subject matter with thinking about the subject matter.* An expert cognitive psychologist knows the discipline but can also use the knowledge. Knowledge without thought is useless, but thought without knowledge is empty. I have tried to balance a respect for subject matter with an equal respect for its use. Every chapter ends with diverse questions that emphasize comprehension of the subject matter, as well as analytic, creative, and practical thinking with that subject matter.

This organization is motivated by my triarchic theory of thinking. However, one does not have to accept the theory to recognize the importance of knowing the facts and of being able to think not just in one but in three different ways with them. Students using this book will not only learn the basic ideas and facts of cognitive psychology, but also how to think with them.

4. *Recognize both the traditional and emerging trends in the field.* This book has all the traditional topics found in the chapters of the large majority of textbooks, including the nature of cognitive psychology (Chapter 1), attention and consciousness (Chapter 3), perception (Chapter 4), memory (Chapters 5 and 6), knowledge representation (Chapters 7 and 8), language (Chapters 9 and 10), problem solving and creativity (Chapter 11), and decision making and reasoning (Chapter 12). I have also included three chapters that are not typically included as chapters in other books.

Cognitive Neuroscience (Chapter 2) is included because the dividing line between cognitive psychology and psychobiology is becoming increasingly indistinct. A great deal of exciting work today is at the interface between the two fields, and so whereas the cognitive psychologist of 20 years ago might have been able to get away without an understanding of biological foundations, I believe that today such a cognitive psychologist would be ill served.

Cognitive development (Chapter 13) is included because the fields of cognitive psychology and cognitive development have increasingly



become part and parcel of the same basic entity. Twenty years ago, the field of cognitive development was still dominated by the Piagetian approach, which made relatively little contact with the main issues being addressed by cognitive psychologists. Today, much of the research being done by cognitive developmentalists is more or less the same as that being done by cognitive psychologists studying adults, except that it is adapted for children. The fields of cognitive psychology and cognitive development have practically merged, and so a cognitive psychologist of today should be aware that the field as a whole encompasses the study of children as well as of adults.

Human and artificial intelligence (Chapter 14) are becoming increasingly important to the field of cognitive psychology. Twenty years ago, the field of human intelligence was dominated by psychometric (test-based) approaches. The field of artificial intelligence was dominated by programs that were functionally rather remote from human thought processes. Today, both fields of intelligence are much more heavily influenced by cognitive models of how people process information. I include both human- and computer-based models in the same chapter because I believe that their goals, ultimately, are the same—namely, to understand human cognition.

Although the book ends with the chapter on intelligence, intelligence also plays a major role in the beginning and the middle of the book, because it is the organizing framework within which cognitive psychology is presented. This framework is not in terms of a traditional psychometric model of intelligence, but rather in terms of intelligence as the fundamental organizing framework for all of human cognition.

I have tried not only to balance traditional and newer topics, but also older and more recent citations. Some books seem to suggest that almost nothing new has happened over the past decade, whereas others seem to suggest that cognitive psychology was invented in that decade. The goal of this book is to balance citation and description of classic studies with equal attention to recent exciting contributions to the field.

5. *Show the basic unity of cognitive psychology.* On the one hand, cognitive psychologists disagree about the extent to which the mechanisms of cognition are domain-specific versus domain-general. On the other hand, I believe that almost all cognitive psychologists believe that there is a fundamental functional unity to human cognition. This unity, I believe, is expressed through the concept of human intelligence.

The concept of intelligence can be seen as providing a unifying umbrella via which to understand the adaptive nature of human cognition. Through this single concept, society, as well as psychological science, acknowledges that as diverse as cognition may be, it comes together in providing us with a functionally unified way of making sense of and adapting to the environment. Thus, the unity of human cognition, as

expressed by the concept of intelligence, serves as an integrating theme for this book.

6. *Balance various forms of learning and instruction.* Students learn best when they learn material in a variety of ways and from different vantage points. To this end, I have sought to achieve a balance among a traditional presentation of text, a variety of kinds of questions about the material (factual, analytic, creative, practical), demonstrations of key ideas in cognitive psychology, and annotated suggested readings that students can consult if they wish further information about a topic. A chapter outline at the beginning of each chapter also serves as an advance organizer for what is to come. The opening questions and closing answers help students appreciate the main questions in the field, as well as what progress we have made toward answering them. The text itself emphasizes how contemporary ideas have evolved from past ones, and how these ideas address the key questions cognitive psychologists have sought to answer in their research.

## Acknowledgments

I am grateful to a number of individuals who have contributed to the development of this book:

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RJS

# To the Student

Why do we remember people whom we met years ago, but sometimes seem to forget what we learned in a course shortly after we take the final exam (or worse, sometimes right before)? How do we manage to carry on a conversation with one person at a party, and simultaneously eavesdrop on another, more interesting conversation taking place nearby? Why are people so often certain that they are correct in answering a question when in fact they are not? These are just three of the many questions that are addressed by the field of cognitive psychology.

Cognitive psychologists study how people perceive, learn, remember, and think. Although cognitive psychology is a unified field, it draws on many other fields, most notably neuroscience, computer science, linguistics, anthropology, and philosophy. Thus, you will find some of the thinking of all these fields represented in this book. Moreover, cognitive psychology interacts with other fields within psychology, such as psychobiology, developmental psychology, social psychology, and clinical psychology.

For example, it is difficult to be a clinical psychologist today without a solid knowledge of developments in cognitive psychology, because so much of the thinking in the clinical field draws on cognitive ideas, both in diagnosis and in therapy. Cognitive psychology has also provided a means for psychologists to investigate experimentally some of the exciting ideas that have emerged from clinical theory and practice, such as notions of unconscious thought.

Cognitive psychology will be important to you not only in its own right, but also in helping you in all of your work. For example, a knowledge of cognitive psychology can help you better understand things such as how best to study for tests, how to read effectively, and how to remember difficult-to-learn material. However, in order best to acquire this knowledge, you need to make use of the following pedagogical features of this book.

1. *Chapter outlines*, beginning each chapter, summarize the main topics covered in each chapter and thus give you an advance overview of what is to be covered in that chapter.
2. *Opening questions* emphasize the main questions each chapter addresses.
3. *Boldface terms*, indexed at ends of chapters and defined in the glossary, help you acquire the vocabulary of cognitive psychology.
4. *End-of-chapter summaries* return to the questions at the opening of each chapter and show our current state of knowledge with regard to these questions.
5. *End-of-chapter questions* help you ensure both that you have learned the basic material and that you can think in a variety of ways (analytical, creative, and practical) with this material.

6. *Annotated suggested readings* refer you to other sources you can consult for further information on the topics covered in each chapter.
7. *Investigating Cognitive Psychology* demonstrations, appearing throughout the chapters, help you see how cognitive psychology can be used to demonstrate various psychological phenomena
8. *Practical Applications of Cognitive Psychology* demonstrations show you how you and others can apply cognitive psychology to your everyday life.
9. “*In the lab of...*” boxes tell you about what it really is like to do research in cognitive psychology. Prominent researchers speak in their own words about their research—what research problems excite them most, and what they are doing to address these problems.
10. *CogLab*. The publisher of this textbook, Wadsworth, has an exciting series of laboratory demonstrations in cognitive psychology that are keyed to this text. You can actively participate in these demonstrations and thereby learn first-hand what it is like to be involved in cognitive-psychological research.

This book contains an overriding theme that unifies all the diverse topics found in the various chapters: Human cognition has evolved over time as a means of adapting to our environment, and we can call this ability to adapt to the environment *intelligence*. Through intelligence, we cope in an integrated and adaptive way with the many challenges with which the environment presents us.

Although cognitive psychologists disagree about many issues, there is one issue about which almost all of them agree; namely, that cognition enables us successfully to adapt to the environments in which we find ourselves. Thus, we need a construct such as that of *human intelligence*, if only to provide a shorthand way of expressing this fundamental unity of adaptive skill. We can see this unity at all levels in the study of cognitive psychology. For example, diverse measures of the psychophysiological functioning of the human brain show correlations with scores on a variety of tests of intelligence. Selective attention, the ability to tune in certain stimuli and tune out others, is also related to intelligence, and it has even been proposed that an intelligent person is one who knows what information to attend to, and what information to ignore. Various language and problem-solving skills are also related to intelligence, pretty much without regard to how it is measured. In brief, then, human intelligence can be seen as an entity that unifies and provides direction to the workings of the human cognitive system.

I hope you enjoy this book, and I hope you see why I am enthusiastic about cognitive psychology, and proud to be a cognitive psychologist.

RJS



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**Also Available:**  
**Readings in Cognitive Psychology**  
**By Robert J. Sternberg and Richard K. Wagner**

Available in Text Choice, a digital database of these readings, at <http://www.textchoice.com>  
 Available separately: 0-15-504105-3  
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