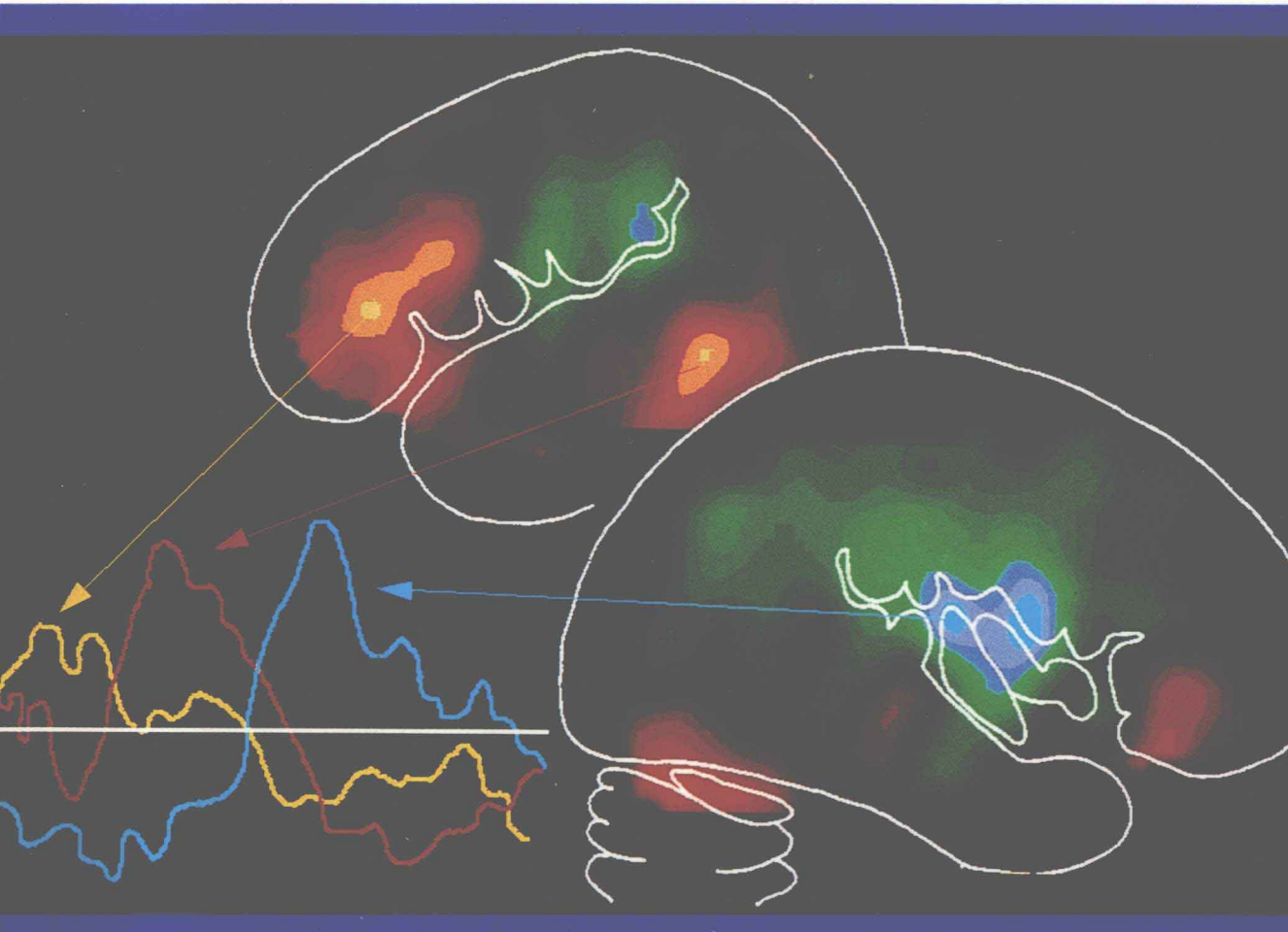
Cognition

Fourth Edition



Stephen K. Reed

COGNITION

Theory and Applications

Fourth Edition

Stephen K. Reed

San Diego State University

Brooks/Cole Publishing Company

I(T)P™ An International Thomson Publishing Company

Pacific Grove • Albany • Bonn • Boston • Cincinnati • Detroit • London • Madrid • Melbourne
Mexico City • New York • Paris • San Francisco • Singapore • Tokyo • Toronto • Washington

Sponsoring Editor: *Marianne Taflinger*
Marketing Team: *Margaret Parks and Carolyn Crockett*
Editorial Assistant: *Laura Donahue*
Production Coordinator: *Fiorella Ljunggren*
Production: *Scratchgravel Publishing Services*
Manuscript Editor: *Betty Berenson*
Permissions Editor: *Lillian Campobasso*
Interior Design: *Anne Draus, Scratchgravel Publishing Services*
Cover Design: *Roy R. Neuhaus*
Cover Photo: *Courtesy of Marcus E. Raichle, M.D., Washington University School of Medicine*
Interior Illustration: *Greg Draus, Cyndie C. H. Wooley, and Judith L. Macdonald*
Typesetting: *Scratchgravel Publishing Services*
Cover Printing: *Phoenix Color Corporation, Inc.*
Printing and Binding: *Quebecor Printing, Fairfield*

COPYRIGHT © 1996, 1992, 1988, 1982 by Brooks/Cole Publishing Company
A Division of International Thomson Publishing Inc.

I(T)P® The ITP logo is a registered trademark under license.

For more information, contact:

BROOKS/COLE PUBLISHING COMPANY
511 Forest Lodge Road
Pacific Grove, CA 93950
USA

International Thomson Publishing Europe
Berkshire House 168-173
High Holborn
London WC1V 7AA
England

Thomas Nelson Australia
102 Dodds Street
South Melbourne, 3205
Victoria, Australia

Nelson Canada
1120 Birchmount Road
Scarborough, Ontario
Canada M1K 5G4

International Thomson Editores
Campos Eliseos 385, Piso 7
Col. Polanco
11560 México D. F. México

International Thomson Publishing GmbH
Königswinterer Strasse 418
53227 Bonn
Germany

International Thomson Publishing Asia
221 Henderson Road
#05-10 Henderson Building
Singapore 0315

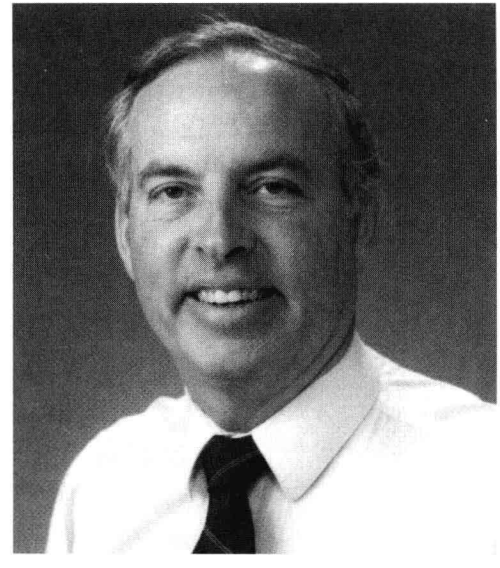
International Thomson Publishing Japan
Hirakawacho Kyowa Building, 3F
2-2-1 Hirakawacho
Chiyoda-ku, Tokyo 102
Japan

All rights reserved. No part of this work may be reproduced, stored in a retrieval system, or transcribed, in any form or by any means—electronic, mechanical, photocopying, recording, or otherwise—without the prior written permission of the publisher, Brooks/Cole Publishing Company, Pacific Grove, California 93950.

Printed in the United States of America

10 9 8 7 6 5

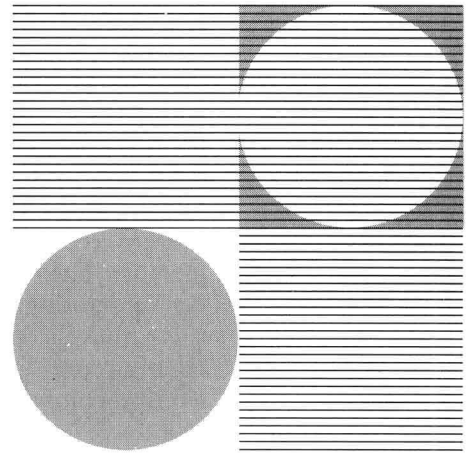
Library of Congress Cataloging-in-Publication Data
Reed, Stephen K.
Cognition : theory and applications / Stephen K. Reed. — 4th ed.
p. cm.
Includes bibliographical references and indexes.
ISBN 0-534-21954-3 (case-bound : alk. paper)
1. Cognition. 2. Cognitive psychology. I. Title.
BF311.R357 1996
153—dc20 95-15683
CIP



Stephen K. Reed is currently professor of psychology and a member of the Center for Research in Mathematics and Science Education at San Diego State University. He has also taught at Florida Atlantic University (1980–1988) and at Case Western Reserve University (1971–1980).

After receiving his B.S. in psychology from the University of Wisconsin in 1966 and his Ph.D. in psychology from the University of California, Los Angeles, in 1970, Dr. Reed worked as an NIH postdoctoral fellow at the Laboratory of Experimental Psychology at the University of Sussex, Brighton, England.

His research on problem solving, carried out in part through grants from NIMH, the National Science Foundation, and the Air Force Office of Scientific Research, has been extensively published in numerous journals, including *Cognition and Instruction; Cognitive Psychology; The Journal of Experimental Psychology: Learning, Memory, and Cognition;* and *Memory and Cognition*. He is the author of numerous articles and books, including *Psychological Processes in Pattern Recognition* (Academic Press, 1973).



Preface

The most exciting development in the field of cognitive psychology is not a particular theory or experimental finding but a general trend. Cognitive psychologists have demonstrated an increasing interest in studying complex, real-world tasks and are making significant progress in understanding how people perform on these tasks. I hope that one result of this trend will be that undergraduates discover the direct relevance of cognitive psychology to many of their daily activities. A course about cognition should be useful not only to psychology students but also to those who have selected other fields of study.

In this book I have attempted to place a greater emphasis on the application of cognitive psychology than is typically found in an undergraduate text. The study of reading, for example, is discussed in the chapters on pattern recognition, attention, language, and text comprehension. Efficient learning strategies are major topics in the chapters on long-term memory and visual imagery. The chapter on expertise and creativity shows how the study of problem solving is currently being extended to include the kinds of problems students encounter in their courses. The chapter on language discusses how the implications of sentences influence legal testimony and advertising, and the chapter on decision making includes a section on applications to medicine and to emergency situations. In order to help students relate the study of cognition to popular articles they are likely to read, I have included many magazine and newspaper clippings on such contemporary topics as

此为试读,需要完整PDF请访问: www.ertongbook.com

implanting false memories and determining the value of a human life in order to justify life-saving decisions.

The 14 chapters in the book cover a wide range of topics, and instructors should be able to expand on whatever topics interest them. The book is divided into three parts: Information-Processing Stages, Representation and Organization of Knowledge, and Complex Cognitive Skills. Part I consists of an introductory chapter followed by chapters on pattern recognition, attention, short-term memory, and long-term memory. The chapters describe what occurs during the different information-processing stages and how the stages interact. Part II contains chapters on levels of processing, visual images, categorization, and semantic organization. The first two chapters in this part describe qualitatively different memory codes, and the next two chapters discuss the organization of knowledge in long-term memory. Part III consists of chapters on language, comprehension and memory for text, problem solving, expertise and creativity, and decision making. The discussion of these complex cognitive skills is often related to ideas presented earlier in the book.

The organization of a book on cognition should reflect what we actually know about cognition. Research suggests that a hierarchy is a particularly effective way to organize knowledge (see Chapter 9). Recall is facilitated when information is partitioned into categories, which are further partitioned into smaller categories. Hierarchical organization seems to be particularly effective when the number of partitions varies from two to five. I deliberately selected such a structure for this book in the hope that the material would thereby be more accessible to students.

The fourth edition retains the same organization as the previous editions. I had two objectives in revising the book: I wanted to help the reader master the information more easily by putting key terms in bold type, by providing a glossary in the margins as well as an alphabetical glossary at the end of the book, and by adding discussion questions at the end of each chapter. Also, I wanted to report on some of the new research that had been done since the publication of the third edition.

Examples of new material include, in Part I, an expanded discussion of the relation of cognitive psychology to other fields including neuropsychology, neural network models, automatic encoding, working memory models, and very long-term retention. Part II, on the representation and organization of knowledge, now contains additional material on the distinctiveness of memory codes, mood-dependent memory, neuropsychological evidence relating imagery and perception, reinterpretation of images, the power of suggestion on the creation of false memories, effect of expertise on categorization, assumptions of schema theory, and autobiographical memory. Additions to Part III, on complex cognitive skills, include new material on vowel discrimination, speech errors, aphasia, individual differences in comprehension, local and global coherence in

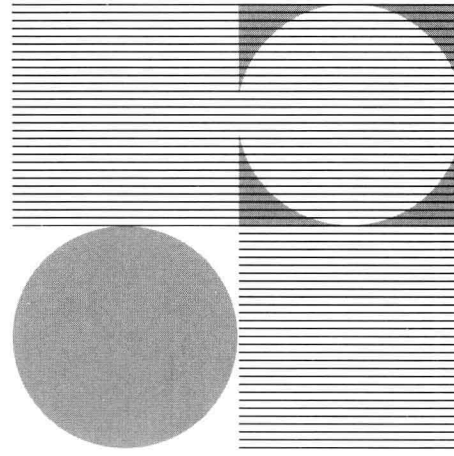
text, situation models for text, improving readability, transfer of problem representations, pragmatic reasoning schemata, effect of examples on creativity, inventing products, effect of mood and decision frames on estimated probabilities, and action-based decision making.

Acknowledgments

I wrote the first edition of this book while spending a sabbatical year at the University of California at Berkeley. I am grateful to Case Western Reserve University and the Group in Science and Mathematics Education at Berkeley for providing financial support during that year. The Group in Science and Mathematics Education also furnished me with a stimulating environment, and the Institute of Human Learning provided an excellent library. Shortly after arriving at Berkeley, I had the good fortune to meet C. Deborah Laughton, a psychology editor at Brooks/Cole. She expressed confidence in the book long before it was deserved and, with the assistance of an excellent staff at Brooks/Cole and first-rate reviewers, helped in the development of the text.

I am grateful to Marianne Taflinger, Fiorella Ljunggren, Anne Draus, Betty Berenson, Lillian Campobasso, and all the others who have contributed to this fourth edition. I would also like to thank the following reviewers for their helpful suggestions on this edition: Charles K. Allen, University of Montana; Stephen Christman, University of Toledo; Ira Fischler, University of Florida; Dennis Kerkman, Southwest Texas State University; John Kruschke, Indiana University; Thomas P. Pusateri, Loras College; Laurette Reeves, Rowan College of New Jersey; and Stephen Schmidt, Middle Tennessee State University. The comments of others are always welcome, and I would appreciate receiving suggestions from readers.

Stephen K. Reed



Brief Contents

I INFORMATION-PROCESSING STAGES ***1***

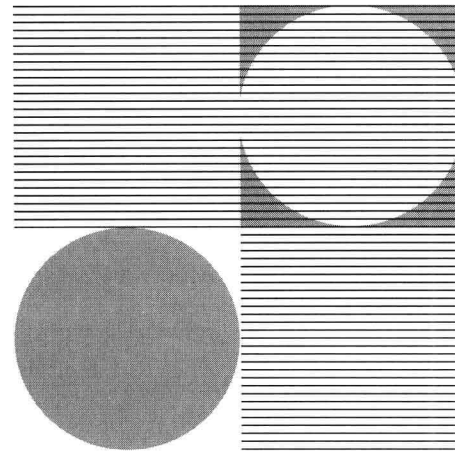
1 Introduction 3
2 Pattern Recognition 19
3 Attention 49
4 Short-Term Memory 79
5 Long-Term Memory 113

II REPRESENTATION AND ORGANIZATION OF KNOWLEDGE ***145***

6 Levels of Processing 147
7 Visual Images 175
8 Categorization 219
9 Semantic Organization 253

III COMPLEX COGNITIVE SKILLS ***289***

10 Language 291
11 Comprehension and Memory for Text 323
12 Problem Solving 353
13 Expertise and Creativity 385
14 Decision Making 413



Contents

Preface **xvii**

I INFORMATION-PROCESSING STAGES ***1***

1 Introduction 3

The Information-Processing Approach 5
The Growth of Cognitive Psychology 7
Cognition's Relation to Other Fields 9
Organization of This Book 13
Study Questions 16
Key Terms 17
Recommended Reading 17

2 Pattern Recognition 19

Describing Patterns 20
Information-Processing Stages 33
Word Recognition 39
Summary 46
Study Questions 47
Key Terms 48
Recommended Reading 48

3 Attention 49

Bottleneck Theories 51
Capacity Theories 58
Automatic Processing 63
Individual Differences and Applications 70
Summary 75
Study Questions 76
Key Terms 77
Recommended Reading 78

4 Short-Term Memory 79

Forgetting 81
Capacity 86
Memory Codes 93
Recognition of Items in Short-Term Memory 103
Summary 110
Study Questions 111
Key Terms 112
Recommended Reading 112

5 Long-Term Memory 113

The Atkinson-Shiffrin Model 116
Control Processes 120
Recognition Memory 129
Indirect Tests of Memory 136
Summary 141
Study Questions 142
Key Terms 143
Recommended Reading 143

II REPRESENTATION AND ORGANIZATION OF KNOWLEDGE ***145***

6 Levels of Processing 147

The Levels-of-Processing Theory 150
Supporting Evidence of the Levels-of-Processing Theory 154
Criticisms and Modifications of the Theory 157
Encoding Specificity and Retrieval 165

Summary 171
Study Questions 171
Key Terms 172
Recommended Reading 173

7 Visual Images 175

Visual Imagery and Learning 177
Mnemonic Strategies 184
Evidence for Images in Performing Cognitive Tasks 191
Limitations of Images 206
Summary 214
Study Questions 216
Key Terms 217
Recommended Reading 217

8 Categorization 219

Concept Identification 221
Natural Categories 226
Categorizing Novel Patterns 239
Summary 248
Study Questions 249
Key Terms 250
Recommended Reading 251

9 Semantic Organization 253

Hierarchical Organization 255
Verification of Semantic Statements 262
Integration of Knowledge 273
Summary 285
Study Questions 286
Key Terms 287
Recommended Reading 287

III COMPLEX COGNITIVE SKILLS ***289***

10 Language 291

Three Aspects of Language 292
Psychology and Grammar 298
Effect of Context on Comprehension 304

此为试读,需要完整PDF请访问: www.ertongbook.com

Implications of Sentences 314
Summary 318
Study Questions 319
Key Terms 320
Recommended Reading 321

11 Comprehension and Memory for Text 323

Prior Knowledge of the Reader 326
Organization of Text 333
Kintsch's Model of Comprehension 342
Summary 349
Study Questions 350
Key Terms 351
Recommended Reading 351

12 Problem Solving 353

Classifying Problems 354
Newell and Simon's Theory 362
General Strategies 369
Summary 380
Study Questions 382
Key Terms 382
Recommended Reading 383

13 Expertise and Creativity 385

Prior Knowledge of the Problem Solver 387
Acquiring Expertise 394
Creativity 400
Summary 408
Study Questions 409
Key Terms 410
Recommended Reading 410

14 Decision Making 413

Making Choices 414
Estimating Probabilities 421
Expected Value 426
Applications 433
Summary 442

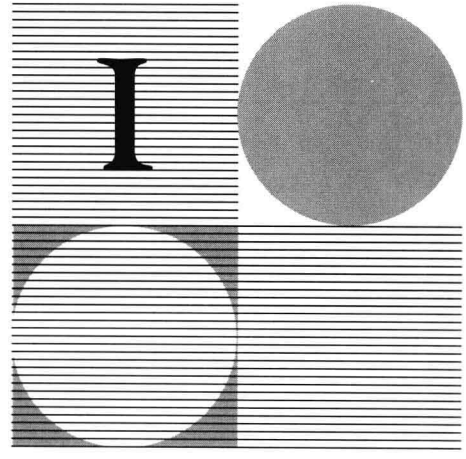
Study Questions 444
Key Terms 445
Recommended Reading 445

Glossary 447

References 457

Name Index 481

Subject Index 486



INFORMATION-PROCESSING STAGES

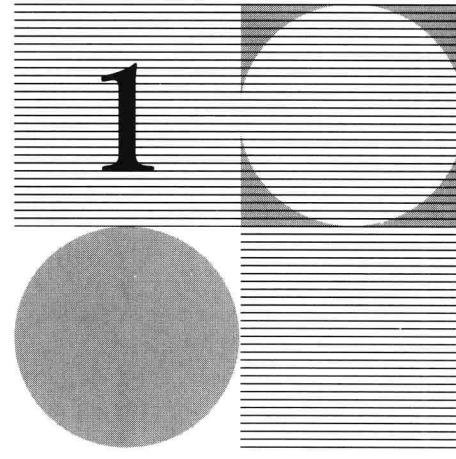
1 Introduction

2 Pattern Recognition

3 Attention

4 Short-Term Memory

5 Long-Term Memory



Introduction

Cognitive psychology refers to all processes by which the sensory input is transformed, reduced, elaborated, stored, recovered, and used.

ULRIC NEISSER (1967)

COGNITION IS USUALLY defined simply as the acquisition of knowledge. However, both the acquisition and the use of knowledge involve many mental skills. If you glanced at the table of contents at the beginning of this book, you saw a list of some of these skills. Psychologists who study cognition are interested in pattern recognition, attention, memory, visual imagery, language, problem solving, and decision making.

The purpose of this book is to provide an overview of the field of cognitive psychology. The book summarizes experimental research in cognitive psychology, discusses the major theories in the field, and attempts to relate the research and theories to cognitive tasks that people encounter in their daily lives—for example, reading, driving, studying, judging advertising claims, evaluating legal testimony, solving problems in the classroom, and making medical decisions.

Neisser's definition of cognitive psychology quoted on the preceding page reflects how psychologists study cognition. Let me repeat it for emphasis: "**Cognitive psychology** refers to all processes by which the sensory input is transformed, reduced, elaborated, stored, recovered, and used."

Cognitive psychology The study of the mental operations that support people's acquisition and use of knowledge

This definition has several important implications. The reference to a sensory input implies that cognition begins with our contact with the external world. Transformation of the sensory input means that our representation of the world is not just a passive registration of our physical surroundings but an active construction that may involve both reduction and elaboration. That is, we can attend to only a small part of the physical stimulation that surrounds us, and only a small part of what we attend to can be remembered. Reduction occurs when information is lost. Elaboration occurs when we add to the sensory input. For example, when you meet a friend, you may recall many shared experiences.

The storage and the recovery of information are, of course, what we call memory. The distinction between storage and recovery implies that the storage of information does not guarantee recovery. A good example of this distinction is the "tip of the tongue" phenomenon. Sometimes we can almost, but not quite, retrieve a word to express a particular thought or meaning. Our later recall of the word proves that the earlier failure was one of retrieval rather than one of storage. The word was stored in memory; it was simply hard to get it back out.

The last part of Neisser's definition is perhaps the most important. After information has been perceived, stored, and recovered, it must be put to good use—for example, to make decisions or to solve problems. We will learn more about problem solving and decision making in Part III, after we review the progress that has been made in understanding perception and memory.

此为试读,需要完整PDF请访问: www.ertongbook.com