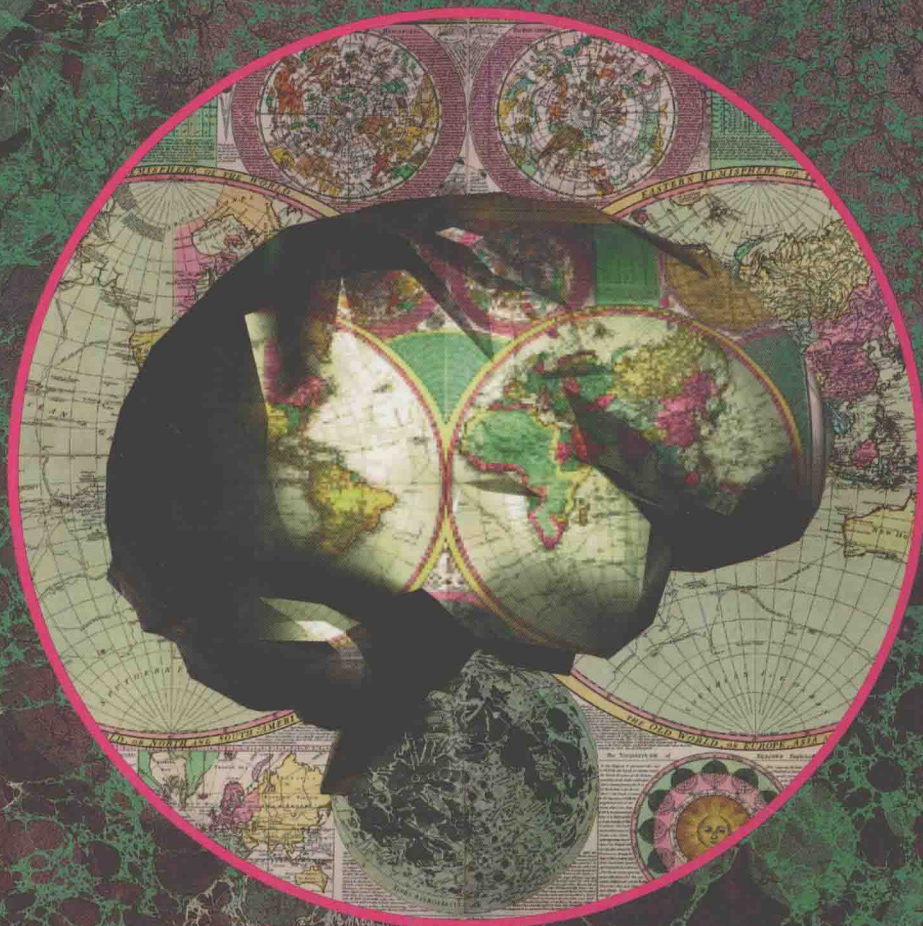


ROBERT L. SOLSO



*Cognitive*  
— PSYCHOLOGY —

FIFTH EDITION

**F I F T H**

**E D I T I O N**

# **COGNITIVE PSYCHOLOGY**

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*To the memory of my mother, Elizabeth Pressly Solso,  
who taught me to love life,  
and to the memory of my father, F. I. Solso,  
who taught me to love knowledge.*

---

*To the Student*

During the history of cognitive psychology, much has been learned about the way people perceive their world, how they form memories, and how thought occurs. These developments are due to the dedicated efforts of numerous cognitive psychologists aided by an improved technology. This combination has yielded a rich harvest of knowledge about perception, memory, neurocognition, thinking, and information processing—indeed, all of human cognition as studied using conventional means throughout the last half of this century.

Among the important recent findings in cognition is the connection between the thinking mind and its corresponding neurophysiological activities. As we are about to leave this remarkable century of advancements in all areas of science and enter perhaps an even more exciting one, I hope to have caught the spirit of these lively times by reporting accurately and in a stimulating way the current findings and theories in cognition.

I hope the contents of this book will let you know where we cognitive psychologists have been; report accurately the best ideas, theories, and experiments; and prepare you to comprehend future developments. You will find that the book follows a sequential model of human cognition from sensation, to perception, to attention, to memory, to higher-order cognition and so on. That system is easy to grasp and gives an order to what may otherwise seem to be a chaotic lot of information; however, it is noted that cognition—perception, neurocognition, memory, consciousness, language use, problem solving and other topics—engage all processes simultaneously. A comprehensive view of cognitive psychology involves an appreciation of all of its multifarious components as they weave their exquisite pattern through the mental life of members of our species.



In most chapters you will find a section called “Critical Thinking.” If we know one thing about learning and cognition it is that an involved reader learns material better and probably at a deeper level of understanding. These critical issue sections are designed to draw you into one or more themes central to the chapter. I encourage you to allow yourself to be drawn in and interact with the text.

Some students may choose to follow a career in a branch of the cognitive sciences. If the contents of this book stimulate you to work toward continuing the job we have started, the labor will have been entirely rewarded.

Finally, I am interested in what you think about the book and would welcome your reactions and comments.

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### ***To the Professor***

Since the first edition of *Cognitive Psychology* was published and through this fifth edition, the basic organization has changed a bit but the substance has changed considerably. In the earlier editions only perfunctory cross references were made to what we now call neurocognition (that term did not come into wide usage until the 1980s). Now, the prominence of neurocognition is palpable in cognitive psychology (and many other areas of psychology) to the extent that other, more traditional fields are beginning to be squeezed out of some textbooks. The spectacular advancements in neurocognition, not only in technology but also in data and their implications, are fully appreciated in the present edition, gaining ground on the fourth edition; but, I am clearly mindful that cognitive psychology is the study of the human mind: its thoughts, its reasoning process, its language, its memory, and the influence on the mind of sensory stimuli. These (and others) are the topics of cognition which neurocognition serves to illustrate, explain, and illuminate (in more ways than one). Because cognition is psychology, I have retained many of the conventional studies that have endured the test of time and the empirical test of science. There is a great temptation to substitute a new study for an old one and, in some instances where the more recent paper illustrates a new facet of a problem, that is justified. However, in many cases an older study is perfectly clear and has been retained. In addition to holding on to the psychological aspects of cognitive psychology this fifth edition also has a multitude of new neurocognitive studies which are included as new verification for cognitive theories.

Writing the first edition of *Cognitive Psychology* was particularly challenging because I had no example to follow except the now classic book of the same title by Ulric Neisser, which was published in 1967, and the hundreds of articles and symposia papers that were unsystematically strewn about my office and home. I did have the good fortune to sit in on Ed Smith’s class on cognition at Stanford University in 1974 (a course I later taught). His organization of material is still in the background (although somewhat modified) in the present book as well as in many other texts in cognition and it seems to me that Ed Smith, who was recently inducted into the National Academy of Sciences, had a hand in the way cognitive psychology is taught throughout the United States and the world. There are now several dozen textbooks in cognitive psychology and many more that discuss topics as far ranging as cognition and the law, cognition and psychotherapy, cognition and society, and cognition and education, to name but a few. Since those early days of the “cognitive revolution,” the sphere of influence of

those interested in this topic has expanded greatly, far exceeding what I envisioned decades ago. However, it is my impression that the major topics that formed the discipline during that time are still viable today, although the emphasis has shifted over the past years—such is the dynamic nature of viable sciences.

In this edition I have tried to retain the best features of the previous editions while adding important new material and changing the emphasis of the book to reflect recent changes. In particular, I have retained the comprehensive nature of the book. There is a risk in writing a comprehensive text in that students may feel overwhelmed with the immense amount of material to cover in a single course. My advice: You do not have to cover the whole book in a single term. More will be said on that a little later.

With the field undergoing significant change and development during the past decade, it has become increasingly difficult to cover all areas of cognition reasonably. I have emphasized mainstream studies and ideas and have eliminated some of the more offbeat aspects of the field. Although there is a need for specialized books that are written from a specific point of view, I trust that many will welcome a comprehensive book on cognitive psychology, a task which only a few writers have attempted.

Those of you who have used *Cognitive Psychology* for the past few years will be pleased to find that for material that presents contradictory findings, an exposition is given, followed by a summary of the results in which certain conclusions are made. This summary was first used in the third edition and is in response to the needs many of you have expressed to me. Also, I have maintained an active laboratory in which some of the ideas expressed in this book are further tested by my students and me. We have occasionally referred to this work for the purpose of both clarifying a principle and letting the reader know that cognitive psychology is an active, ongoing science. It is hoped that such studies will lead some to continue the search for more complete answers to some of the questions raised.

As with the third and fourth editions, most chapters begin with a brief review of the historical antecedents of the topic presented; however, in some chapters this review has been shortened to make room for current information. Since the field of cognitive psychology changes so rapidly, I believe it is important for readers to know something of the history of a topic so that they may understand new information within the context of past events.

Revising a book one dearly loves for the fourth time is a bittersweet experience. On one hand, it is really exhilarating to include new studies which answer some of the issues presented in previous editions; on the other hand, surveying my floor littered with deleted pages, paragraphs, and sentences of carefully crafted material, for one who hates to cut a single word, is something akin to seeing a bit of intellectual life drain away. I particularly disliked pruning some of the historical material on memory research but could not justify holding on to that space when so many more interesting findings needed to be represented. In addition to adding new references to most chapters and removing some out-of-date studies, this edition emphasizes the following things:

- A new chapter on consciousness is added which was written by Bernard Baars and Katie McGovern. Professor Baars is one of the leading experts in this field and he and Katie McGovern are excellent writers. Chapter 6 on consciousness is a blend of their writing and my own. The addition of a separate chapter on consciousness marks a significant departure from most other texts in cognition as it recognizes a

subject which, although greatly defamed and misunderstood by previous generations, has emerged as a principle theme of cognition and will surely have a place in twenty-first century psychology. The study of consciousness is difficult, but we believe that science should not be content to solve only easy problems. The topic of consciousness over the years would not go away—it, like the long-lost lover of country music fame, was “always on our mind.” So, we have acknowledged the conspicuous and have treated it like any other psychological variable which may be subjected to hypothesis building, theory development, and empirical testing.

- There is a significant addition of new physiological information and related topics, including recent findings in neurocognitive imaging technology. The inclusion of these topics is in response to the rapidly changing nature of cognitive psychology and important new discoveries in the field of brain science and neurocognition.
- The organization of the chapters and sections follows an information-processing sequence that starts with the perception of signals by the sensory/brain system to higher-order processes such as memory, language, and thinking. The present edition contains seven sections that follow the above organizational schema. This sequence has been one that students and professors find easy to follow although the INFOPRO model of cognition is not the only model students are exposed to in this book. And, it is my opinion that cognition is a multifarious affair in which all parts work together more or less simultaneously. While people have little difficulty following a sequential processing model, it should be pointed out that memory without perception is like a beautiful painting without paint.
- Attention has been given to neurally inspired models of connectionism and parallel distributed processing (PDP). Although these matters are concentrated in a few places (Chapters 1, 2, and 9), they are (appropriately) also distributed throughout the book.
- Most chapters have a section called Critical Thinking in which the reader is encouraged to analyze or contemplate the immediate subject matter. I have found that these sections, and others you might invent, are a good means of stimulating discussion in class. Students tend to think more deeply about issues and probably retain the knowledge better when topics are discussed. Class discussion also provides an opportunity for students to practice and improve their analytic skills.
- This edition is colorful. We found that adding a second color in the fourth edition enlivened the pages, made ideas appear more distinct, and enhanced the visualization of figures and tables. The result is a book that is more appealing and, ultimately, more instructive. I hope you find the use of a second color pleasing and helpful in your effort to offer an interesting and informative class on cognitive psychology.

In writing a comprehensive book on cognitive psychology, it is my intention to present a work that would be attractive to many professors who prefer to select their favorite topics for coverage in a one-term class. It may be possible to cover all sixteen chapters in one course, but most professors have told me that they select certain chapters and not others. (In my own class I cover all but one or two chapters, although an enterprising graduate student of mine covered the entire book in one five-week summer



## Critical Issues

Most chapters have at least one box on critical issues which are designed to stimulate critical thinking on the part of the reader. By engaging the student in interesting and unresolved issues it is anticipated that the learning of the material will be more complete and might be more stimulating. Cognition is much more than the rote memorization of facts, names, experiments and the like: It is wonderfully dynamic. There are questions left unanswered and inquiring minds, such as those of your students, might continue the work we have started. One way to structure the discussion would be to consider the questions in light of:

- *Theoretical Questions.* What are the universal properties of the mind these issues address?
- *Practical Issues.* How do these matters influence my everyday life?

- *Methodological Matters.* How were the results obtained? Were there problems in the technique? What other means might be used to gather data regarding this phenomenon?
- *Associated Problems.* How do these critical issues relate to other problems within and outside of cognitive psychology? How, for example, does a critical issue in perception relate to neurocognition? What are other critical issues?

Please try out the critical issues boxes, discuss them in class or in discussion groups (if practical), and invent some of your own. (Please send along your own Critical-Thinking boxes and I may share them with others in the next edition.)

session!) I have written the text so that some chapters may be dropped without losing the continuity of the book. Following are several suggested models:

1. A brief general introduction to cognition—Chapters 1, 3, 4, 6, 7, 8, 12, 13, 15, and 16.
2. A neurocognitive system—Chapters 1, 2, 3, 5, 7, 8, 9, 12, 14, and 17.
3. An applied approach—Chapters 1, 3, 4, 5, 7, 8, 9, 10, 11, 14, 15, 16, and 17.
4. A thinking/problem-solving emphasis—Chapters 1, 4, 5, 7, 8, 9, 11, 14, 15, 16, and 17.
5. A Memory Course—Chapters 1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13, 14, and 15.
6. A Cognitive-Developmental Course—Chapters 1, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, and 16.

These models of chapters are only basic suggestions to which chapters of your own liking and/or specialty may be added or other melds created.

Many people have contributed to this book, and it is a pleasure for me to recognize them here. Many of you, faithful users over the years, have expressed your opinions of the book to me in person or by letter. Your continued use is most deeply appreciated, and your comments have been most important. Also, the students who have written or

given me feedback in several ways have helped me keep in contact with the most important group—namely, the people to whom the book is directed. Many researchers have kept me informed on their latest discoveries, and to you I am particularly obliged. In numerous instances many of you have sent me preprints and reprints of your important work from sources that would otherwise be practically impossible to find. Here I acknowledge with thanks the draft of Chapter 6 on consciousness by able scholars and adroit writers, Bernard Baars and Katie McGovern. The manuscript for the third edition was professionally reviewed by William S. Cassel, University of New Orleans; Thomas Busey, Indiana University at Bloomington; Doug Eamon, University of Wisconsin, Whitewater; and Darlene DeMarie-Dreblow, Muskingum College. My graduate students, Otto MacLin and M. Kimberly Beal, co-authored the instructor's manual and served as a constant reminder of for whom the book is really written. To all, I humbly acknowledge your valuable assistance and express my heartfelt thanks.



# C O N T E N T S

*Preface* xv

## **SECTION I INTRODUCTION AND THE NEURAL BASIS OF COGNITION**

---

### **1 Introduction 1**

**What Is Cognitive Psychology? 2**

**Information-Processing Model 4**

**The Domain of Cognitive Psychology 7**

Cognitive Neuroscience 7 Perception 7 Pattern Recognition 8  
Attention and Consciousness 8 Memory 9 Imagery 10  
Representation of Knowledge 10 Language 10 Developmental  
Psychology 11 Thinking and Concept Formation 11 Human  
Intelligence 11 Artificial Intelligence 12

**Antecedents of Modern Cognitive Psychology 12**

The Representation of Knowledge: The Early Period 12  
The Representation of Knowledge: The Middle Period 15  
The Representation of Knowledge: Early Twentieth Century 17  
The Reemergence of Cognitive Psychology 19

**Conceptual Science and Cognitive Psychology 21**

Cognitive Models 23 The Computer Metaphor and Human  
Cognition 25 Cognitive Science 27 Neuroscience and Cognitive

Psychology 27 Parallel Distributed Processing (PDP)  
and Cognitive Psychology 29 Evolutionary Psychology  
(Cognitive Bionomics) 30

**Summary 32**

**Key Words 33**

**Recommended Readings 33**

## **2 Cognitive Neuroscience 34**

**Exploring and Mapping the Brain—An Introduction 35**

**Mind-Body Issues 36**

**Neurocognition 38**

Cognitive Psychology and Neuroscience 39

**The Nervous System 40**

The Neuron 40 The Brain: From Compartmentalization  
to Mass Action 44 The Anatomy of the Brain 46

**Neurophysiological Sensing Techniques 52**

MRI and EPI 55 CAT Scans 55 PET Scans 55

**A Tale of Two Hemispheres 61**

Cognitive Psychology and Brain Science 68

**Summary 68**

**Key Words 69**

**Recommended Readings 69**

## **SECTION II PERCEPTION AND INTERPRETATION OF SENSORY SIGNALS**

---

### **3 Perception of Sensory Signals 70**

**Sensation and Perception 72**

Illusions 73 Previous Knowledge 73 Sensory-Brain  
Predisposition 75 Threshold 77

**Signal Detection Theory 80**

Observer's Criterion and the Concept of Threshold 82

**Perceptual Span 83**

**Iconic Storage 85**

Effect of Delay of Cue 85 Capacity 86 Icons and Iconoclasts 87

Echoic Storage	88
Function of Sensory Stores	90
Summary	91
Key Words	92
Recommended Readings	92
<b>4 Pattern Recognition</b>	<b>93</b>
Perceptual Theories	96
Visual Pattern Recognition	98
Vision 98    Subjective Organization	99
Gestalt Theory	101
Canonic Perspectives	104
Bottom-Up versus Top-Down Processing	107
Template Matching	108
Geon Theory 111    Priming Technique	112
Feature Analysis	114
Eye Movements and Pattern Recognition	116
Prototype Matching	118
Abstraction of Visual Information 118    Pseudomemory	120
Prototype Theory: Central-Tendency versus Attribute-Frequency	122
Form Perception: An Integrated Approach	123
Pattern Recognition among Experts	124
Pattern Recognition in Chess	124
Pattern Recognition—The Role of the Perceiver	127
Summary	127
Key Words	128
Recommended Readings	128

## **SECTION III ATTENTION AND CONSCIOUSNESS**

---

<b>5 Attention</b>	<b>129</b>
Processing Capacity and Selective Attention	133
Auditory Signals 134    Visual Signals	135



**Models of Selective Attention 137**

The Filter Model: Broadbent 137    The Attenuation Model: Treisman 140

**Automatic Processing 145****The Neurocognition of Attention 147**

Activation and Habituation 147    Attention and the Human Brain 149

**Attention and Electrical Fields in the Brain 151****Summary 152****Key Words 154****Recommended Readings 154****6 Consciousness: New Developments  
on an Enduring Topic 155****History of Consciousness 156****Cognitive Psychology and Consciousness 159**

Explicit and Implicit Memory 159    Hippocampal and Amnesic  
Studies 160

**Consciousness as a Variable 161****Consciousness as a Scientific Construct 162**

Limited Capacity 164    Widespread Access 165    The Activation  
Threshold 165    The Novelty Metaphor 166    The Spotlight 166  
An Integration Metaphor: The Theater in the Society of Mind 167

**Modern Theories of Consciousness 168**

Schacter's Model of Dissociable Interactions and Conscious Experience  
(DICE) 168    Shallice's Supervisory System 170    Baars' Global  
Workspace Theory 171

**Functions of Consciousness 177****Summary 178****Key Words 179****Recommended Readings 179**

---

**SECTION IV MEMORY****7 Memory: Theories and Neurocognition 180**

Early Studies 181

**The Neurocognition of Memory 185****Two Memory Stores 187****Memory in the Larger Cognitive Domain 189****Models of Memory 191**

Waugh and Norman 191 Atkinson and Shiffrin 192 Level of Recall (LOR) 194 Level of Processing (LOP): Craik 196 Self-Reference Effect (SRE) 199 Episodic and Semantic Memory: Tulving 202 A Connectionist (PDP) Model of Memory: Rumelhart and McClelland 205

**Summary 210****Key Words 211****Recommended Readings 211****8 Memory: Structures and Processes 212****Short-Term Memory 213**

Neurocognition and STM 215 Capacity of STM 216 The Coding of Information in STM 219 Retrieval of Information from STM 227

**Long-Term Memory 229**

Neurocognition and LTM 230 LTM: Storage and Structure 231 Very Long-Term Memory (VLTM) 235 Autobiographical Memories 240

**Summary 245****Key Words 245****Recommended Readings 246****9 The Representation of Knowledge 247****Semantic Organization 249****Associationist Approach 249**

Organizational Variables: Bower 249

**Semantic Memory: Cognitive Models 250**

Set-Theoretical Model 250 Semantic Feature-Comparison Model 253 Network Models 255 Propositional Networks 259

**Representation of Knowledge—Neurocognitive Considerations 266**

The Search for the Elusive Engram 266 What Amnesic Patients Tell Us When They Forget 266 Knowing What and Knowing That 268 A Taxonomy of Memory Structure 269

**Connectionism and the Representation of Knowledge 270**

**Summary 273**

**Key Words 274**

**Recommended Readings 274**

## **SECTION V MNEMONICS, EXPERTS, AND IMAGERY**

---

### **10 Mnemonics and Experts 275**

**Mnemonic Systems 275**

Method of Loci 275 Peg Word System 278 Key Word Method 280  
Organizational Schemes 282 Recall of Name 284 Recall of Words 285

**Extraordinary Memories 286**

S.: Luria 286 V.P.: Hunt and Love 290 Others 291

**Experts and Expertise 292**

The Structure of Knowledge and Expertise 294 Theoretical Analysis  
of Expertise 295

**Summary 296**

**Key Words 297**

**Recommended Readings 297**

### **11 Mental Imagery 298**

**Historical Overview 299**

**Imagery and Cognitive Psychology 300**

Dual-Coding Hypothesis 303 Conceptual-Propositional Hypothesis 304  
Functional-Equivalency Hypothesis 305

**Neurocognitive Evidence 310**

**Cognitive Maps 317**

Mental Maps: Where Am I? 318

**Synesthesia: The Sound of Colors 321**

**Summary 324**

**Key Words 325**

**Recommended Readings 326**

**SECTION VI LANGUAGE AND THE DEVELOPMENT OF COGNITION**

---

**12 Language 1: Structure and Abstractions 327****Language: Cognition and Neurology 328****Linguistics 331**

Linguistic Hierarchy 331 Phonemes 332 Morphemes 333  
Syntax 335

**Chomsky's Theory of Grammar 335**

Transformational Grammar 336

**Psycholinguistic Aspects of Language 339**

Innate Properties and Environmental Effects 339 Linguistic-Relativity  
Hypothesis 339

**Cognitive Psychology and Language: Abstraction of Linguistic  
Ideas 342**

"The War of the Ghosts": Bartlett 342 "Ants Ate the Jelly":  
Bransford and Franks 345

**Knowledge and Comprehension 348**

"Soap Opera" and "Thieves" 349 "Bumper Stickers and the Cops":  
Kintsch and van Dijk 349

**A Model of Comprehension: Kintsch 351**

Propositional Representation of Text and Reading 352

**Language and Neurology 354****Summary 357****Key Words 358****Recommended Readings 359****13 Language 2: Words and Reading 360****Perceptual Span 362**

Text Processing: Eye Tracking 367

**Interactive Activation Model and Letter and Word Identification:  
A PDP Perspective 372**

Lexical-Decision Task (LDT) 375 Word Recognition: A Cognitive-  
Anatomical Approach 378