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*Cognitive
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***Cognitive
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**by Dr Peter J Hills and
Dr J Michael Pake**

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Cognitive Psychology For Dummies®

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Contents at a Glance

<i>Introduction</i>	1
<i>Part I: Getting Started with Cognitive Psychology</i>	5
Chapter 1: Understanding Cognition: How You Think, See, Speak and Are!	7
Chapter 2: Studying Cognitive Psychology Means Studying the Everyday	19
Chapter 3: Improving Academic Performance with Cognitive Psychology	27
<i>Part II: Attending to the Subtleties of Perception</i>	41
Chapter 4: Perceiving the World around You	43
Chapter 5: Seeing How People See Depth and Colour	63
Chapter 6: Recognising Objects and People	81
Chapter 7: Atten-hut! Paying Attention to Attention	99
<i>Part III: Minding Your Memory</i>	115
Chapter 8: Where Did I Put My Keys? Short-Term Memory	117
Chapter 9: You Don't Remember Our Wedding Day? Long-Term Memory	135
Chapter 10: Knowing about Knowledge	153
Chapter 11: Discovering Why You Forget Things	167
Chapter 12: Memorising in the Real World	179
<i>Part IV: Communicating What Your Brain Thinks about Language</i>	191
Chapter 13: Communicating the Extraordinary Nature of Language	193
Chapter 14: Studying the Structure of Language	211
Chapter 15: Talking about Language Perception and Production	225
Chapter 16: Discovering the Links between Language and Thought	239
<i>Part V: Thinking Your Way around Thought</i>	253
Chapter 17: Uncovering How People Solve Problems	255
Chapter 18: Thinking Logically about Reasoning	267
Chapter 19: Making Up Your Mind: Decision-Making	281
Chapter 20: Thinking Clearly about the Role of Emotions	293
<i>Part VI: The Part of Tens</i>	311
Chapter 21: Studying Patients with Brain Damage	313
Chapter 22: Ten Tips for Writing Successful Research Reports	321
Chapter 23: Busting Ten Cognitive Psychology Myths	329
<i>Index</i>	335

Table of Contents

<i>Introduction</i>	1
About This Book	1
Conventions Used in This Book.....	2
Foolish Assumptions.....	2
Icons Used in This Book	3
Beyond the Book	4
Where to Go from Here.....	4
<i>Part 1: Getting Started with Cognitive Psychology</i>	5
Chapter 1: Understanding Cognition: How You Think, See, Speak and Are!	7
Introducing Cognitive Psychology	7
Hypothesising about science	8
Describing the rise of cognitive psychology	9
Looking at the structure of cognition (and of this book)	10
Researching Cognitive Psychology	13
Testing in the laboratory	13
Modelling with computers.....	14
Working with brain-damaged people	15
Analysing the brain.....	16
Acknowledging the Limitations of Cognitive Psychology	17
Chapter 2: Studying Cognitive Psychology Means Studying the Everyday	19
Recognising the Relevance of Cognitive Psychology.....	20
Paying attention in the real world	20
Understanding memory in the real world	21
Reading about language in the real world	23
Thinking in the real world	24
Studying Cognitive Systems to See What Goes Right . . . and Wrong	25
Accepting that Cognitive Psychology Doesn't Have All the Answers.....	25
Chapter 3: Improving Academic Performance with Cognitive Psychology	27
Engaging Your Perception and Attention.....	27
Massing your practice.....	28
Capturing attention	29
Focusing attention	29
Avoiding distraction.....	29

Improving Your Learning and Memory	30
Working the memory.....	30
Storing for the long term.....	31
Avoiding forgetting.....	32
Retrieving information quicker.....	32
Polishing Up Your Academic Reading and Writing Skills.....	33
Reading strategically.....	33
Improving your writing.....	35
Using Your Thinking Powers More Effectively	36
Using rational logic.....	37
Planning systematically.....	37
Creating and using sub-goals.....	37
Automating components.....	38
Working backwards.....	38
Developing a growth mindset.....	38

Part II: Attending to the Subtleties of Perception..... 41

Chapter 4: Perceiving the World around You 43

Delving into Your Perception System.....	43
Seeing What's Going on in the World.....	45
Positioning the eye.....	45
Staring into the eye.....	46
Organising the visual brain.....	50
Constructing What You See in the World.....	52
Directing perception.....	53
Resolving ambiguities in perception.....	54
Following a World in Motion.....	55
Perceiving motion.....	55
Going with the optic flow.....	57
Timing your move is everything.....	58
Showing your animal nature: Biological motion.....	59
Seeing is believing: Apparent motion.....	60

Chapter 5: Seeing How People See Depth and Colour 63

Seeing the Third Dimension.....	63
Introducing depth perception.....	64
The eye of the tiger: Monocular cues.....	64
Flexing the eye muscles: Physiological cues.....	68
Using both eyes together: Binocular cues.....	70
On the move: Motion cues.....	71
Combining the depth cues.....	72

Living Life in Colour	72
Defining colour	73
Counting the colours: Trichromacy theory.....	73
Colours in opposition: Adding more colours to the colour wheel.....	75
Colour constancy: How colours remain the same.....	78
Categorical perception: Keeping colours divided	79

Chapter 6: Recognising Objects and People 81

‘Just Move a Bit, I Can’t See the View!’ Separating Figures from Background.....	81
Using spatial frequencies.....	82
Putting the world together: Gestaltism.....	83
‘What’s It Meant to Be?’ Perceiving Patterns to Recognise Objects	85
Shaping up to recognise by components	86
Sketching the world.....	87
Recognising based on views.....	87
‘Hey, I Know You!’ Identifying Faces	88
Testing the specialness of face recognition	88
Modelling face recognition	92

Chapter 7: Atten-hut! Paying Attention to Attention 99

‘Hey, You!’ Grabbing Attention	99
Priming the pump	100
Failing to notice the obvious	101
Visual search: Looking for a needle in a haystack.....	102
‘Now Concentrate!’ Controlling Attention	105
Investigating selective attention.....	105
Getting your divided attention.....	108
Pushing things to the limit.....	108
Running on Autopilot.....	109
Interfering with attention.....	110
Practising to make perfect.....	111
When Things Go Wrong: Attention Disorders	112
Ignoring the left: Spatial neglect	112
Having trouble paying attention: ADHD.....	113

Part III: Minding Your Memory..... 115

Chapter 8: Where Did I Put My Keys? Short-Term Memory 117

Splitting Memory Up	117
Meeting the multi-store model of memory	118
Characterising STM	119



- Putting Your Memory to Work..... 121
 - Storing and repeating sounds: The phonological loop 122
 - Sketching and imagining: The visuospatial sketchpad 124
 - Bringing long-term memories to mind: The episodic buffer 125
 - Introducing the managing director: The central executive..... 126
 - Calculating your working memory 128
- Processing Your Memory – Executively 129
 - Focusing your attention 129
 - Switching attention..... 130
 - Ignoring what’s unimportant..... 130
 - Scheduling and planning..... 131
 - Monitoring yourself..... 132
 - Seeing where it all happens: The frontal lobes 132

Chapter 9: You Don’t Remember Our Wedding Day?

Long-Term Memory 135

- Digging Deep: Levels of Processing Memories 136
- Classifying Long-Term Memories 137
 - ‘Let me tell you all about it!’ Declarative memory..... 138
 - ‘But I don’t know how I do it!’ Non-declarative memory 139
- Storing and Recalling Long-Term Memories 144
 - Consolidating memories 144
 - Retrieving memories 145
 - Travelling back to the future: Prospective memory 148
- Looking at When Memory Goes Wrong 149
 - Failing to form new memories..... 150
 - Losing stored memories 150

Chapter 10: Knowing about Knowledge 153

- Thinking of Knowledge as Concepts 154
 - Introducing the idea of concepts..... 154
 - Ordering concepts: Hierarchies..... 155
 - Wheeling away at the hub-and-spokes model..... 157
- Organising Knowledge in Your Brain..... 158
 - Scheming your way to knowing 158
 - Scripting knowledge 160
 - Finding your way around with routes 160
- Representing Items in Your Head..... 161
 - Defining attributes 161
 - Comparing to averages 163
 - Examining exemplar theory..... 163
- Putting Aside Knowledge in Your Brain 164
 - Storing in modules 164
 - Distributing knowledge 164

Chapter 11: Discovering Why You Forget Things 167

'It's on the Tip of My Tongue!' Forgetting Things	167
Paying insufficient attention.....	168
Failing to encode properly.....	168
Decaying from memory.....	169
Interfering with stored memories.....	170
Forgetting the cues	172
Intending to Forget.....	173
Forgetting on purpose.....	173
Repressing memories.....	174
Creating False Memories	175
Associating things incorrectly	175
Distorting memory.....	176
Talking things through: Verbal overshadowing.....	177

Chapter 12: Memorising in the Real World 179

Remembering Yourself and Your Life.....	179
Measuring the accuracy of your autobiographical memories	180
Thinking about what you remember – and why	180
Wondering whether all autobiographical memories are the same	182
Flashing Back in Time	182
Being an Eyewitness.....	183
Making eyewitness errors.....	185
Identifying criminals.....	187
Improving eyewitness testimony.....	188

***Part IV: Communicating What Your
Brain Thinks about Language 191*****Chapter 13: Communicating the Extraordinary
Nature of Language 193**

Monkey Business: Looking at Language in the Animal Kingdom	194
Investigating how animals communicate.....	194
Recognising other languages (in sea and space).....	196
Teaching language to other species.....	199
Discovering What Makes Human Language Special.....	199
Getting specific on what sets human language apart:	
Hockett's design features.....	200
A system of language: According to Noam Chomsky.....	201
Infinite creativity: Writing the world's longest sentence, and making it longer.....	202
Relating language to other human skills.....	203

‘Uggh. Mama. Me Want Be Psychologist!’	
Developing Language Skills	204
Picking up language skills in childhood.....	204
Following the stages of language acquisition in children.....	205
Learning languages in later life	206
Speaking more than one language.....	206
Considering language development in extreme circumstances	207
Chapter 14: Studying the Structure of Language	211
Staring at the Smallest Language Units.....	211
Working with Words	212
Morphing language: Fanflippingtastic!.....	212
Inventing and accepting new words.....	214
Reading the long and the short of it.....	215
Seeing What Sentences Can Do.....	215
Looking at sentence ambiguity	216
Writing grammatical rubbish!	219
Talking nonsense	220
Building Stories that Mean Something.....	223
Chapter 15: Talking about Language	
Perception and Production.	225
Decoding the Art of Reading	225
Reading from A to Z: Alphabetic principle	226
Teaching reading	227
Seeing how you read	228
Looking up words in the brain.....	230
Putting Together Coherent Sentences.....	232
Producing a sentence	233
Looking at models of sentence production.....	233
Recognising Speech as Speech	234
Distinguishing different meanings from the same sound	235
Segmenting speech.....	235
Delving into Language Problems	236
Being lost for words: Aphasias.....	236
Sequencing the genes: Specific language impairment	237
Speaking in foreign tongues.....	237
Having trouble reading: Dyslexia.....	237
Chapter 16: Discovering the Links between	
Language and Thought	239
Investigating the Idea that You Need Language to Think.....	240
Connecting language to thought.....	240
Considering cross-cultural language differences.....	241
Telling this from that: Categorical perception.....	242
Presenting the evidence from child development.....	242
Covering other cognitive abilities.....	243

Thinking without Language: Possible or not?.....	244
Bringing consciousness into the debate.....	245
Seeing the same: Universal perception.....	246
‘Well, I just dunnit really’: Expertise.....	248
It started with a thought: Mentalese	248
‘I don’t remember doing that – honestly!’	249
Comparing the Opposing Arguments	249

Part V: Thinking Your Way around Thought 253

Chapter 17: Uncovering How People Solve Problems 255

Experimenting to Reveal Thought Processes: Gestalt Psychology.....	256
Defining the problem.....	257
Monkeying around with insight	257
Getting stuck in a rut: Functional fixedness	258
Watching the Rise of the Computers: Information Processing Approaches	259
Welcoming computers to the struggle.....	259
Seeing the state space approach	260
Perusing protocol analysis	261
Examining Expert Problem-Solving	262
Analysing the memories of expert chess players.....	262
Learning to become an expert	262
Emulating the experts to improve your problem-solving.....	263
Modelling How Learners Learn with Intelligent Tutoring Systems.....	264
Improving problem-solving comes with experience	265
Using analogies in problem-solving.....	265

Chapter 18: Thinking Logically about Reasoning 267

Testing Human Logic	267
Introducing humans: The logical animal?.....	268
Confirming confirmation bias with two problems.....	268
‘It’s Only (Formally) Logical, Captain’	270
Identifying four reasoning rules.....	271
Understanding the importance of context	272
Reasoning with Uncertainty: Heuristics and Biases	274
Taking a shortcut – to the wrong answer!.....	274
Weighing down people’s thinking: Anchoring	275
Ignoring the base rate	275
Explaining Reasoning with Models.....	276
Using probabilities and Bayesian reasoning	276
Solving problems with similar structures	278
Using heuristics successfully in the real world	279
Making mental models	280

Chapter 19: Making Up Your Mind: Decision-Making 281

Researching Real-World Decision-Making.....	282
Thinking speedily.....	282
Studying how people make decisions: Normative theories	284
Understanding why heuristics work when normative theories fail	285
Framing the problem.....	285
Deciding to Look into Your Brain.....	286
Handling annoying issues: The multiple demand system	286
Seeing how brain damage affects decision-making	287
Tracing the development of decision-making.....	288
Remembering the role of experiences	289
Altering People's Decisions.....	289
Assisting public-health information	289
Tackling supermarket manipulation	290
Deliberating about jury decision-making.....	291

Chapter 20: Thinking Clearly about the Role of Emotions. 293

How Do You Feel? Introducing Emotions	294
Looking at ways of defining emotion.....	294
Ouch! Developing emotional responses	295
Thinking about emotion.....	297
Recognising the Reach of Emotion.....	298
Attending to emotions and perception.....	298
Remembering to cover memory and mood!.....	300
Speaking about language and emotion	302
Thinking that you may be in a mood.....	303
Looking Behind the Reality: How Mood Interacts with Cognition	304
Activating feelings: Emotional network	304
Maintaining focus: Resource allocation model.....	305
Trusting your feelings: Informative emotions.....	306
Choosing an appropriate processing type: The affect-infusion model.....	307
Encountering Emotions Going Wrong.....	308
Stimulating arousal for memory	309
Worrying about anxiety	309

Part VI: The Part of Tens..... 311**Chapter 21: Studying Patients with Brain Damage 313**

Smelling More than Normal.....	313
Losing Track of Movement.....	314
Failing to Recognise Faces.....	314

(Almost) Neglecting the World 315
 Forgetting What You Learn 316
 Knowing that Knowledge Is Slipping Away 316
 Developing without Language..... 317
 Reading but Not Understanding Words..... 317
 Struggling to Speak Grammatically 318
 Changing Personality 319

Chapter 22: Ten Tips for Writing Successful Research Reports . . . 321

Using the Correct Format 322
 Including Background Research..... 323
 Criticising Existing Research 323
 Developing Testable Hypotheses 324
 Providing Detailed Methods..... 325
 Presenting Your Results Clearly 326
 Interpreting Results within Theories 326
 Suggesting Future Research 327
 Avoiding Criticising the Sample..... 327
 Don't Knock Ecological Validity 328

Chapter 23: Busting Ten Cognitive Psychology Myths 329

Using Your Whole Brain 329
 Seeing Depth with Two Eyes 330
 Failing to See Colour, in Men..... 330
 Falling for a Symmetrical Face 331
 Memorising like a Tape Recorder..... 331
 Listening to Mozart Makes You Smarter 332
 Getting Aggressive about Computer Games 332
 Hunting for Free Will 333
 Communicating Differently as a Man or a Woman 334
 Hypnotising You to Do Anything..... 334

***Index*..... 335**

Introduction

The fact that you're reading this book implies that you have an interest in cognitive psychology or you're studying it for a course. In either case, you probably think that you know what cognitive psychology is: the study of all mental abilities and processes about knowing. Clearly, the subject covers a huge range whose contents would barely fit into 50 books the size of this one – with more being written every day!

We think that everybody should be interested in cognitive psychology, because it's fascinating. We know that all aficionados say that (from bell ringers to beer-mat collectors), but cognitive psychology really is! By scientifically studying how people see, remember, know, speak and think, you can truly understand what being human means and what makes all humans special.

About This Book

Cognitive Psychology For Dummies is designed as an introduction to the subject. We cover the historical perspective on cognitive psychology, but also draw on interesting, more recent work.

We adopt an informal writing style, but one that remains technically appropriate and scientifically accurate. We write in plain English (which is tricky, because cognitive psychologists love jargon!). Where we do use technical language you can assume that it's the only way to express something, but overall we make the tone as friendly as possible. We even include some jokes (if you don't spot any, it's because we're not very funny!). At no point are we making fun of anyone (except ourselves).

We endeavour to relate everything in this book to everyday reality, using real-world examples to anchor the more technical information. Nevertheless, cognitive psychologists like to create highly controlled, laboratory-based experiments that, on the surface, bear little resemblance to the real world. Don't fear though; everything cognitive psychologists study has some benefit to humanity.

Most chapters also cover instances of ‘when things go wrong’. These discussions show how a particular cognitive ability can go haywire in healthy people (such as visual illusions) or those with brain damage.

This book is for people who need and want to know about cognitive psychology. For the former, we present all the information covered in school and the first year of a university course (anywhere in the world) in a highly accessible way. We map the content onto the most common courses of cognitive psychology. If you simply want to know about cognitive psychology, we present some of the most interesting and fun psychology here too. We pack the book with examples and exercises you can try out and demonstrate on your friends and family to amaze them!

Conventions Used in This Book

We use conventions to help you find your way around this book easily:

- ✓ *Italic* text highlights new, often specialist, terms that we always define nearby. These include elements of jargon we just can’t escape, though we also use italics for emphasis.
- ✓ **Boldfaced** text indicates part of a list or numbered steps.

Unlike most textbooks in psychology, we don’t include references or in-text citations. We mention the name of a researcher when we feel that the person’s work is important and worth remembering.

We sometimes describe a few of the most important and influential studies, but not always. Be assured, however, that all the results and effects we describe in this book are based on empirical research – we simply don’t want to get bogged down in such detail too often.

We also provide a number of sidebars, containing additional information with more detailed theories, methodologies or clinical examples. You can skip over these without missing anything essential, but we think they’re interesting and add a lot to the text.

Foolish Assumptions

Hundreds of books on cognitive psychology exist. Many are technical, long, dry, specialised or cover a very narrow area of cognition. We wrote *Cognitive Psychology For Dummies* assuming the following:

- ✔ You want to understand how people think, see and remember things.
- ✔ You have questions about how the human mind works.
- ✔ You're starting a course in cognitive psychology and haven't studied it before.
- ✔ You've found other textbooks too complicated, dry or technical.
- ✔ You're simply interested in people.
- ✔ You have a basic understanding of psychology, probably from an introductory course or reading *Psychology For Dummies*.
- ✔ You want to discover a few tips on improving your own cognition.

Icons Used in This Book

Throughout this book, we use icons in the margins to help you find certain types of information. Here's a list of what they mean.



When you see this icon, we're giving you a bit of information that may come in handy someday.



Don't forget the information by this icon! It shows what you need to pick up from the particular paragraph.



Like most sciences, cognitive psychology has a lot of terms and particular usages. We highlight them with this icon so that you can join in the conversation wherever cognitive psychologists gather.



This icon flags text that rises above what you need for a basic understanding of the topic at hand. You can skip these paragraphs if you prefer without harming your comprehension of the main point. We often use this icon when describing studies in detail or the brain regions involved in cognition.



We use this icon to point out how the information under discussion has applications or is observed in reality.



This icon indicates a task or exercise to perform on yourself or someone you know. The exercises are based on examples we provide in the text or on an Internet resource.

Beyond the Book

The area of cognitive psychology is so vast that its contents would fill far more than this book. Given that it's really interesting and exciting, we want to give you as much chance to learn about it as possible, and so we put some extras on the Internet. In addition to the printed chapters, you can find loads more (free!) *Cognitive Psychology For Dummies* information at www.dummies.com/extras/cognitivepsychology.

In an online cheat sheet found at www.dummies.com/cheatsheet/cognitivepsychology, we include a quick guide to some central cognitive psychology ideas on memory, language and problem solving, among other topics.

Where to Go from Here

We organise this book in a logical representation of how the human brain works (information comes in, is remembered, spoken and thought about), but each chapter is self-contained so that you can dip in and out at your leisure. Except for the first and last parts, each part deals with a different element of cognitive psychology, so you can pick out the sections that you're most interested in or are struggling with the most.

Use the table of contents and index to find what's most relevant to you. If you're new to the subject, you may want to start with Chapter 1 and read the book in sequence, but you don't have to read it cover to cover.

We hope that you find the book educational, informative and entertaining. We think that you'll like it and learn a lot about yourself as you go. If you do, tell your friends about it!

Part I

Getting Started with Cognitive Psychology

getting started
with

**Cognitive
Psychology**



Go to www.dummies.com for bonus information about cognitive psychology and almost any other topic that interests you.

In this part . . .

- ✔ Understand what cognitive psychology is and why it's so darn important.
- ✔ Realise how cognitive psychology influences every aspect of the human experience that involves thinking.
- ✔ Find useful tips on how cognitive psychology can improve your cognitive skills in school, college, university and almost all walks of life.

Chapter 1

Understanding Cognition: How You Think, See, Speak and Are!

In This Chapter

- ▶ Defining cognitive psychology
 - ▶ Detailing the discipline's research methods
 - ▶ Looking at some limitations
-

How do you know that what you see is real? Would you notice if someone changed her identity in front of you? How can you be sure that when you remember what you saw, you're remembering it accurately? Plus, how can you be sure that when you tell someone something that the person understands it in the same way as you do? What's more fascinating than looking for answers to such questions, which lie at the heart of what it means to be . . . well . . . you!

Cognitive psychology is the study of all mental abilities and processes about knowing. Despite the huge area of concern that this description implies, the breadth of the subject's focus still sometimes surprises people. Here, we introduce you to cognitive psychology, suggesting that it's fundamentally a science. We show how cognitive psychologists view the subject from an information-processing account and how we use this view to structure this book.

We also describe the plethora of research methods that psychologists employ to study cognitive psychology. The rest of this book uses the philosophies and methods that we describe here, and so this chapter works as an introduction to the book as well.

Introducing Cognitive Psychology



Cognitive psychologists, like psychologists in general, consider themselves to be *empirical* scientists – which means that they use carefully designed experiments to investigate thinking and knowing. Cognitive psychologists (including us!) are interested in all the seemingly basic things that people

take for granted every day: perceiving, attending to, remembering, reasoning, problem solving, decision-making, reading and speaking.

To help define cognitive psychology and demonstrate its ‘scientificness’, we need to define what we mean by a science and then look at the history of cognitive psychology within this context.

Hypothesising about science



Although many philosophers spend hours arguing about the definition of science, one thing that’s central is a systematic understanding of something in order to make a reliable prediction. The *scientific method* commonly follows this fairly strict pattern:

1. Devise a testable hypothesis or theory that explains something.

An example may be: how do people store information in their memory? Sometimes this is called a *model* (you encounter many models in this book).

2. Design an experiment or a method of observation to test the hypothesis.

Create a situation to see whether the hypothesis is true: that is, manipulate something and see what it affects.

3. Compare the results obtained with what was predicted.

4. Correct or extend the theory.

Philosopher Karl Popper suggested that science progresses faster when people devise tests to prove hypotheses wrong: called *falsification*. After you prove all but one hypothesis wrong about something, you have the answer (the Sherlock Holmes approach – if you exclude the impossible, whatever remains must be true!). This is also called *deductive reasoning* (see Chapter 18 for the psychology of deduction).

The scientific method has some clear and obvious limitations (or strengths, depending on the way you look at it):

- ✔ **You can hypothesise and test only observable things.** For this reason, many cognitive psychologists don’t see Sigmund Freud, Carl Rogers and others as scientists.
- ✔ **You must conduct experiments to test a theory.** You can’t do research just to find out something new.



Cognitive psychology employs the scientific method vigorously. Everything we describe in this book comes from experiments that have been conducted following this method. Although this does sometimes limit the questions you can ask, it establishes standards that all research must follow.

Describing the rise of cognitive psychology

Before cognitive psychology, people used a variety of approaches (or *paradigms*) to study psychology, including behaviourism, psychophysics and psychodynamics. The year 1956, however, saw the start of a cognitive renaissance, which challenged, in particular, behaviourism. For more background on how cognitive psychology emerged from other scientific disciplines, chiefly behaviourism, check out the nearby sidebar '1956: The year cognitive psychology was born'.

We don't intend to minimise the importance of behaviourism: it ensured that the scientific method was applied to psychology and that experiments were conducted in a controlled way. Cognitive psychology took this strength and carried it into more ingenious scientific studies of cognition.

1956: The year cognitive psychology was born

The behaviourist approach dominated psychology until 1956, when enough people found that it was insufficient to understand human behaviour. Specifically, behaviourism couldn't explain cognition. Part of the issue was that virtually all behaviourist research was conducted on animals (usually rats and pigeons), and perhaps humans are different to animals. Interest in new areas also proved difficult for the behaviourist model to deal with. Imagery, short-term memory, attention and the organisation of knowledge can't be easily interpreted within the behaviourist model, because behaviourists are only interested in observable behaviour.

The attack on behaviourism became venomous, with American linguist Noam Chomsky

leading the charge. He claimed that the behaviourist analysis for language learning was wrong (for reasons we discuss in the chapters in Part IV). His attack coincided with a series of other key papers that showed behaviourism was waning and cognitive science was the way forward: George Miller's paper on the magic number seven (see Chapter 8), Allen Newell and Herb Simon's problem-solving model (Chapter 17), and the birth of artificial intelligence. All this happened in 1956. This *cognitive renaissance* culminated in the first textbook on cognitive psychology in 1967 by Ulric Neisser, a German-American cognitive psychologist. He described this book as an attack on behaviourism.

Looking at the structure of cognition (and of this book)

Fittingly, we're writing this book to bring cognitive psychology to a wider audience around the 50th anniversary of the first published cognitive psychology textbook (in 1967).

Applications

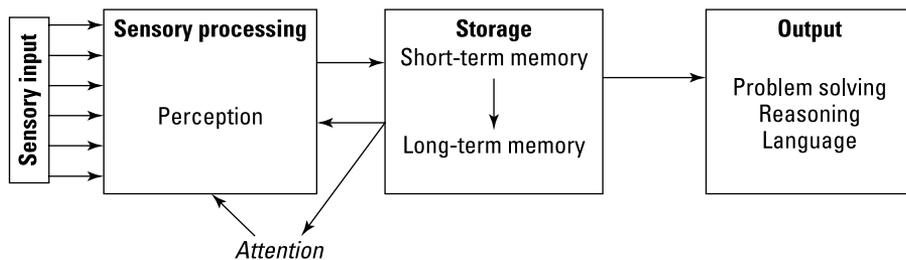
In Part I, we review the applications of cognitive psychology and why studying it is important. Cognitive psychology has produced some incredibly exciting and interesting findings that have changed how people view psychology and themselves (as you can discover in Chapter 2). But also, people have learnt a great deal about how best to teach, learn and improve themselves from cognitive psychology, something we address in Chapter 3. The applications of cognitive psychology are so wide that studies are used in such disparate fields as computing, social work, education, media technology, human resources and much more besides.

Information-processing framework

In this book, we follow the *information-processing* model of human cognition. In many ways, this approach to cognition is based on the computer. The idea is that human cognition is based on a series of processing stages. In 1958, Donald Broadbent, a British psychologist, argued that the majority of cognition follows the processing stages we depict in Figure 1-1. The boxes represent stages of cognition and the arrows represent processes within it.



Figure 1-1:
Basic
processes
in cognition
according to
information
processing.



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All cognition fits within this framework. Cognitive psychologists research each box (stage) and each arrow (process) in Figure 1-1 in many different domains. In other words, this framework provides a good structure for how to think about and learn about cognitive psychology (and oddly matches the framework of this book).



Your leg bone's connected to your knee bone

Cognitive psychology's favoured information-processing framework corresponds well with how the brain seems to process information. People have sensory organs that detect the world. These connect to parts of the brain devoted to perception (in the case of vision, the *occipital lobe* in the back of the head). The information then passes forward from the perception centres to the attention centres (*the parietal*

cortex, just in front of the occipital lobe) and then to the memory centres (*the temporal lobe*, in the middle of the head). Higher-level reasoning and thinking are primarily processed in the *frontal lobes* at the front of the head. Although a gross oversimplification, this description is a nice fit with the information-processing account of cognition.



Information processing may not be as simple as Figure 1-1, progressing in perfect sequence from the sensory input to long-term storage. Existing knowledge and experience may cause some processing to be in reverse. These two patterns of processing are often referred to as follows:

- ✓ **Bottom-up processing:** Physical environment and sensation drive brain processing.
- ✓ **Top-down processing:** Existing knowledge and abilities drive responses.

All forms of cognitive psychology are based on the interaction between bottom-up and top-down processing. No processing is strictly driven by the stimulus or by knowledge.

Cognitive psychologists like the information-processing framework, because people's interactions with the world are guided by internal mental representations (such as language) that can be revealed by measuring the processing time. Neuroscientists have also found parts of the brain responsible for different cognitive behaviours.

Input

In Part II of this book, we look at the first stage of cognition: input of information. In the computer analogy, this would be a camera recording information or the keyboard receiving key presses.



Cognitive psychologists call the input of information *perception*: how the brain interprets the information from the senses. Perception is different from *sensation*, which is exactly what physical information your senses record. Your brain then immediately changes and interprets this information so that

it's easy to process. This process highlights a linear progression from sensation (Chapter 4) to perception (Chapters 5 and 6).

Attention follows information input (see Chapter 7). *Attention* is the first distinct process of the information-processing account, and it's what links perception with higher-level cognition. Without it, people would simply react to the world in an involuntary manner.

Storage

After you attend to information, it enters your brain's storage system (see the chapters in Part III). The brain has a number of mechanisms for storing and using information, collectively called *memory*. We cover short-term memory in Chapter 8 and long-term memory in Chapter 9. You also have stored knowledge and skills (Chapter 10). Although all this knowledge is highly useful, we can't forget(!) to consider forgetting (Chapter 11), as well as how memory works in everyday life and some of the applications of memory research (Chapter 12).



In the computer analogy of cognition, short-term memory is the RAM: it has limited capacity and simply keeps the information you're currently using available to you. Just as you can't have too many applications or windows open on a computer simultaneously without slowing it down, the same applies to human short-term memory. Long-term memory and knowledge is the hard-disk space – a vast store of information.

Language and thought

Sensation and perception are quite low-level cognitive functions: they're fairly simple processes that many animals can do. Memory is a slightly higher-level cognitive function, but the highest-level functions are the ones that animals can't do, according to some psychologists – language and thought (see Parts IV and V):



- ✓ **Language:** The first output stage of information processing. Some psychologists describe it as a human form of communication and it's typically the vocal form of exchanging ideas with other people. We describe language and its relation to other forms of communication in Chapter 13. We cover its structure and the steps needed to produce it in Chapters 14 and 15. We discuss how language relates to other parts of cognition and perception in Chapter 16.
- ✓ **Thought:** The second output stage of information processing. Problem solving, reasoning and decision-making (Chapters 17, 18 and 19, respectively) are complex, highly evolved abilities that are an accumulation of extensive experience, knowledge and skill. Plus, don't forget how cognition is affected by emotions (Chapter 20).