



DANIEL SCHACTER  
DANIEL GILBERT  
DANIEL WEGNER  
BRUCE HOOD

SECOND EUROPEAN EDITION

# PSYCHOLOGY

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First published 2016 by  
PALGRAVE

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Palgrave Macmillan in the US is a division of St Martin's Press LLC, 175 Fifth Avenue, New York, NY 10010.

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ISBN 978–1–137–40674–3

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A catalogue record for this book is available from the British Library.

A catalog record for this book is available from the Library of Congress.

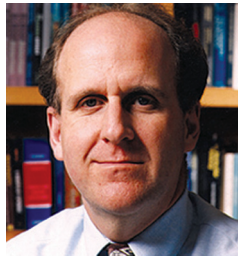
*To my girls, Kim, Martha and Esmé*

Bruce Hood

*We dedicate this edition to the memory of Dan Wegner,  
our co-author, colleague and deeply missed friend*

Daniel Schacter and Daniel Gilbert

## About the authors



**DANIEL SCHACTER** is William R. Kenan, Jr Professor of Psychology at Harvard University. Dan received his BA from the University of North Carolina at Chapel Hill. He subsequently developed a keen interest in amnesiac disorders associated with various kinds of brain damage. He continued his research and education at the University of Toronto, where he received his PhD in 1981. He taught at the faculty at Toronto for the next six years before joining the psychology department at the University of Arizona in 1987. In 1991, he joined

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# Preface

For most of our adult lives, we have been studying the human mind and teaching our students what we and other psychologists have learned about it. We've each written articles in professional journals to convey our findings and ideas to our colleagues, and we've each published popular nonfiction titles to communicate with the general public. For each of us, though, something important has been missing: a text written specifically for students. Reading a textbook should be just as engaging as reading a popular book, and we've worked hard to make sure that happens in *Psychology*.

## Talking about psychology from a new perspective

As we wrote this textbook, we found ourselves confronting a question: Why were we attracted to psychology in the first place? Although we each have different interests in psychology that cover a broad range of the field – from cognitive psychology to social psychology to developmental psychology and neuroscience – we all share a common fascination with the errors, illusions, biases and other mental mistakes that reveal how the mind works.

We believe psychology is interesting in large part because it offers insights into the errors of human thought and action. Some of these errors are familiar and amusing (why do we forget jokes the moment we've heard them?), and others are exceptional and tragic (what causes a pilot to fail to deploy his landing gear on approach?). But all of them cry out for explanation. Indeed, if our thoughts, feelings and actions were error free, our lives would be orderly, predictable and dull – and there would be few mysteries for psychology to illuminate.

But human behaviour is endlessly surprising, and its surprises are what motivate us to understand the psychological complexities that produce them. Why is memory so prone to error, and what can be done to improve it? How can people discriminate against others even when they're trying hard not to? How can mobs make normal people behave like monsters? What allows a child with an IQ of 50 to compose a symphony? How can newborn babies know about kinetics and occlusion when they can't even find their own fingers? Psychology offers the possibility of answering such questions from a scientific perspective, and it is this possibility that drew us to the field.

## Explaining the 'mindbugs' approach

Every rambunctious child knows that you can learn how a toy works by breaking it. If you want to understand things so that you can eventually fix them and even build new ones, knowing how they break is invaluable. When things break, we learn about the pieces and processes that normally work together. Breakdown and error are not just about destruction and failure – they are paths to knowledge. Psychology has long

followed these paths. The ‘bugs’ of the human mind reveal a great deal about its function, structure and design. For example:

- Freud and other pioneers studied psychological disorders not only to alleviate human misery, but because the disordered mind provides a window through which to view normal psychological functioning
- The social blunders of people with autism teach us how human beings usually manage to have such seamless interactions
- Depression teaches us how most people deal so effectively with the losses and heart-breaks of everyday life
- Visual illusions teach us how the eye and brain normally generate visual experiences that correspond so faithfully to the realities they represent.

These and other examples of mindbugs are integrated throughout the chapters:

- Phantom limb syndrome, in which amputees can feel their missing limbs moving and even feel pain in their absent limbs, sheds light on plasticity in the brain (Chapter 3, p. 111)
- The experience of synaesthesia, where certain musical notes can evoke visual sensations of certain colours or certain sounds can produce an experience of specific tastes, provides clues about how perception works (Chapter 4, pp. 132–3)
- The ‘seven sins’ of memory are aspects of forgetting and distortion that show how people reconstruct their pasts and also reveal the adaptive functions of memory (Chapter 5, pp. 220–1)
- Savants, such as an English boy named Christopher who was fluent in 16 languages yet lacked the cognitive capacities to live on his own, provide striking evidence that cognition is composed of distinct abilities (Chapter 7, p. 267)
- Stereotyping teaches us how people use categories to make predictions about objects and events they have never seen before (Chapter 14, pp. 596–601)
- Placebo treatments such as sugar pills or therapies with no ‘active ingredients’ can still sometimes be effective and so show how susceptible we are to psychological influences on our health (Chapter 17, pp. 696–8).

Our experience as teachers suggests that students are every bit as fascinated by these mental oddities as we are. So we’ve incorporated these inherently interesting examples of human behaviour throughout the text. Derived from the idea of ‘computer bugs’, we refer to these examples as ‘mindbugs’. Mindbugs are useful in illuminating the mechanisms of human psychology: they relate seemingly different topics to one another and highlight the strengths of the human mind as well as its vulnerabilities. We have used these errors, mistakes and behavioural oddities as a thematic focus in each of the domains traditionally covered by introductory textbooks.

This approach has at least two benefits:

- 1 It provides a conceptual linkage between chapters on normal psychological functions (such as memory, perception and emotion) and chapters on pathology (such as psychological disorders and mental health).
- 2 Psychologists know that most errors occur when normally adaptive mechanisms temporarily misbehave. For example, the tendency to stereotype others is not merely a bad habit acquired from ignorant parents but a misuse of the normally adaptive tendency to categorize objects and then use what one knows about the category to pre-judge the object itself. A focus on mindbugs invites students to think of the mind as an adaptive solution to the problems that human beings face in the real world.

## The brain and the classic issues in psychology

Just as psychologists come to understand the mind by observing the instances in which it fails and considering the problems it has adapted to solve, they also understand the mind by examining the brain. Traditionally, psychologists have relied on nature’s occasional and inexact experiments to teach them about the function of the brain, and the study of brain-damaged patients continues to be an important source of new information. In the



past two decades, emerging neuroimaging technologies, such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET), have allowed psychologists to peer deep into the healthy, living brain as well. These two methods have led to the birth of a new field called ‘cognitive neuroscience’, and the findings from this field are already shedding light on some interesting and familiar problems. Consider these examples:

- When people have hallucinations, do they actually see pink elephants and hear the voice of God? Neuroimaging studies have shown that visual and auditory hallucinations are accompanied by increased activity in the regions of the brain normally activated by real visual and auditory experience. This suggests that people really are seeing and hearing during hallucinatory episodes.
- When people claim to remember satanic rituals and childhood sexual abuse, are they really remembering? Neuroimaging studies have revealed that false memories are accompanied by activity in the regions of the brain normally associated with true memories, suggesting that people who claim to remember such events are, in fact, having a memorial experience.
- When people cannot describe how they got somewhere but drove there ‘on autopilot’, have they really learned the route? Studies of amnesiac patients have revealed that when the patients practise a task, they generally show improvements similar to those of healthy volunteers, despite the fact that they cannot remember ever having performed the task.

Cases such as these provide a natural entry to discussions of fundamental issues in perception, memory and motivation. The brain is the basis of all psychological phenomena, and imaging technologies reveal how the brain creates the miracle of the mind. Our decision to integrate neuroscience in this way reflects the current direction in which the field of psychology is moving. The brain is no longer just the province of specialists – the widespread use of imaging techniques has allowed a whole generation of researchers who study cognition, development, personality, emotion and social psychology to become excited about the possibility of learning how the brain and the mind are interrelated. We have attempted to bring this excitement and new knowledge to introductory students through vivid case illustrations, brain images and nontechnical explanations.

## Written to inspire, teach and respect students’ intelligence

An introduction to psychology should focus on what is most important and what is most compelling. It should not be a rehashing of all things psychological. To ensure that *Psychology* offers the very best of psychological science, we formed our contributing consultants board and expert reviewer panel in areas outside our own areas of expertise. They advised us on early drafts and throughout the writing process, explaining what is important, what is true, and how to think about the issues and data in their respective fields. Taking this information, we have addressed topics in each subfield of psychology in the greater context of that field as a whole. Each chapter has a narrative arc that tells the story of that field of psychology and provides a thematic context that will hook students from the start. In writing *Psychology*, we have made informed choices about our topic coverage, weighing classic studies and current research to produce a contemporary perspective on the field. We believe that our approach engages students, teaches students, entertains students and, above all, inspires them as we are inspired by psychology.

## An additional note for lecturers on the European Edition

*Psychology: First European Edition*, published in 2012 and based on the original US text *Psychology* by Daniel Schacter, Daniel Gilbert and Daniel Wegner, was thoroughly revised and updated by Bruce Hood to meet the needs of students across Europe, the

UK and beyond. He added a broad range of international research, as well as amusing and interesting cultural references from across the globe.

Drawing on the feedback from a large panel of specialists, every chapter was revised for an international audience and to bring it in line with BPS guidelines for British students. Substantial revisions were made to:

- Chapter 2 **The methods of psychology**: This was adapted and expanded to include more coverage of statistics, such as inferential statistics, t-tests, probability/statistical significance, chi-square, contingency and correlation coefficients. A new section was added on qualitative methods.
- Chapter 5 **Memory**: This was revised to provide a balance between British and global approaches in relation to memory, while also discussing Daniel Schacter's 'seven sins of memory' approach. More emphasis was placed on working memory, flashbulb memory and metamemory.
- Chapter 9 **Intelligence**: This was reworked with a European audience in mind in conjunction with Ian Deary from the University of Edinburgh – one of the world authorities in the field. New sections on emotional intelligence and creativity, and the cognitive basis of intelligence were added.
- Chapter 11 **Development**: This was rewritten and divided into two chapters – Chapter 11 **Cognitive development** and Chapter 12 **Social development**. Coverage of new international research and theories was included, making the chapters at the cutting edge of developmental psychology. There is a strong and distinctive cognitive neuroscience flavour to the new Chapter 11.
- Chapter 16 **Psychological disorders**: The symptom-oriented approach advocated by Bentall was a noteworthy addition to this chapter and is very much a departure from traditional psychiatric diagnosis models. A new section on the difference between DSM and ICD classification systems was added, as well as more discussion of Kraepelin, and a new section on the symptom-oriented approach to diagnosis and on post-traumatic stress disorder (PTSD).

All these additions and changes are maintained in the second edition, and we outline what is new in this textbook below.

## New to the second edition

*Psychology: Second European Edition* has been thoroughly updated with new research and hot topics throughout. Some notable additions are:

- **Two new chapters on social psychology**: the first edition's chapter on social psychology has been hugely expanded and divided into two separate chapters. Chapter 14 **Social relationships** discusses the evolutionary approach, nonverbal communication, reproduction, relationships and loneliness. Chapter 15 **Social groups** examines identifying with groups, stereotyping, social acceptance and attitudes.
- **Brand new psychomythology boxes**: these tackle misconceptions about psychology held by the general public, dispelling myths with the use of scientific evidence and logic, and encouraging critical thinking. Examples include:
  - With two choices, it's not always 50:50 (p. 82)
  - You only use 10% of your brain (p. 126)
  - You can learn in your sleep (p. 263)
  - When unsure, it's best to stick to your first hunch (p. 307)
  - People can be hypnotized to kill (p. 352)
  - Money makes you happier (p. 424)
  - Your handwriting can reveal your personality (p. 551)
  - Schizophrenics have a Jekyll and Hyde split personality (p. 666)
- **Brand new Psychology and me videos**: these video interviews and associated text boxes feature psychology graduates talking about their current roles as teachers, researchers and practitioners, highlighting what they enjoyed most and found most challenging about their undergraduate degrees and providing nuggets of advice for

students just starting their course. They demonstrate the wide range of careers available to students after they leave university and also the exciting applications of psychological research. See p. xxxii for a list of interviewees.

- **Increased coverage of research methods and statistics:** the second edition has more on qualitative methods and new sections on deduction, induction, Hume and Popper, effect sizes and the problems with significance and probability. **Brand new stats facts boxes**, which deal with thorny issues in statistics, are peppered throughout. Examples include:
  - Are women better at multitasking? First ask a Bayesian (p. 139)
  - The dark origins of the Likert scale (p. 602)
  - ‘Ch-ch-changes’: problems of detecting significant change (p. 440)
- **New hot science boxes throughout:** there is at least one new hot science box in every chapter, bringing the second edition right up to date with cutting-edge research and neuroscience. Examples include:
  - Brain soup (p. 88)
  - Wishful seeing (p. 161)
  - Forgive and forget (p. 195)
  - Of mice and men: learning to become fearful (p. 238)
  - ‘Far out’ thinking (p. 302)
  - Waking the brain (p. 343)
  - Were the Victorians smarter than us? (p. 384)
  - Are you looking for a fight? (p. 398)
  - Darkness makes us shadier characters (p. 608)
  - Fear of holes (p. 642)
  - Ancient wisdom, modern mindfulness (p. 687)
- **New the real world boxes, humorous margin anecdotes, and opening vignettes** in selected chapters, for example Alan Turing in Chapter 1, Nelson Mandela in Chapter 14 and narcolepsy in Chapter 8.

The second edition also offers new sections in all chapters, as follows:

#### Chapter 1 **Psychology: the evolution of a science**

- Epistemology: continental rationalists and British empiricists
- Early European women pioneers
- Practising psychology in Europe

#### Chapter 2 **The methods of psychology**

- Deduction, induction and Hume and Popper
- Effect size
- The problems with significance and probability

#### Chapter 3 **Neuroscience and behaviour**

- Executive functions
- Epigenetics

#### Chapter 4 **Sensation and perception**

- Study on binding in chicks
- The importance of illusions

#### Chapter 5 **Memory**

- Childhood reminiscing
- Survival-related encoding
- Computerized working memory training

#### Chapter 6 **Learning**

- More on Little Albert
- Contingency and blocking

#### Chapter 7 **Language and thought**

- New study on segmentation in gesture
- Thinking fast and slow

**Chapter 8 Consciousness**

- Halloween study of self-consciousness
- The dreaming brain

**Chapter 9 Intelligence**

- Replication of Shih et al. 1999 Asian priming study
- More on creativity

**Chapter 10 Emotion and motivation**

- Botox and mimicking emotional expression
- More on Capgras syndrome and the function of emotion
- Yerkes-Dodson law
- Self-determination and internalization
- Daydreaming and ego depletion
- Unpredictability and emotion

**Chapter 11 Cognitive development**

- More on motor development
- Affordances on visual cliff
- Motor behaviour predicts school achievement
- More on causality
- Executive function and intelligence

**Chapter 12 Social development**

- Overimitation
- Self-esteem and inflated praise
- Trust and marshmallow test
- Gender bias in motor development
- Empathy, ownership and sharing

**Chapter 13 Personality**

- Peer influence

**Chapter 16 Psychological disorders**

- Introduction and critique of new DSM-5
- Problems of biopsychosocial model
- R. D. Laing
- Critique of classic Rosenhan experiment
- New approaches to understanding multiple levels of causation
- Winter-over syndrome and polar T3 syndrome
- Cultural differences in hearing voices

**Chapter 17 Mental health**

- Recent ECT imaging study
- More on stress response in the HPA
- Loneliness and illness
- The placebo effect

# Author's acknowledgements

I would like to thank the Dans for their support. It was an honour to be asked to adapt *Psychology* into the First European Edition, and to come on board as an author of the Second European Edition. As you will see, the style is very accessible without losing any of the importance of the science covered. During work on this second edition, Dan Wegner passed away, which was a tremendous loss not only to his family and friends but also the field. Part of who we are lives on in our children but also in the minds of others who we shape with our ideas. Dan Wegner shaped many minds and this textbook will continue to pass on his legacy.

I would also like to thank the team at Palgrave, especially Amy Grant and Paul Stevens who guided me along the way.

*Psychology: Second European Edition* has been improved by the comments and suggestions of colleagues and anonymous reviewers. I have endeavoured to incorporate their criticisms and insights to bring this edition fully up to date and make it the most engaging and comprehensive textbook available for students across the UK and Europe. I would like to thank Richard Rowe and Brendan Gough for their work on Chapter 2, The methods of psychology; David Lieberman for his contribution to Chapter 6, Learning; and I am particularly indebted to Ian Deary for his source material which was the basis for much of Chapter 9, Intelligence. Thanks also to Ian for contributing a photograph of his relation, Richard Deary, for the chapter.

I am indebted to the University of Bristol, which has provided a wonderfully supportive environment.

I would also like to thank our advisory panel for their valuable input on the previous edition and the new edition draft manuscript:

- Jason Bohan, University of Glasgow, UK
- Zoltan Dienes, University of Sussex, UK
- Paul Dockree, Trinity College, Dublin, Ireland
- Natalie Donaldson, Rhodes University, South Africa
- Roger Donaldson, Karlstad University, Sweden
- Karen Douglas, University of Kent, UK
- Eddie Edgerton, University of the West of Scotland, UK
- Graeme Fairchild, University of Southampton, UK
- Simon Goodman, Coventry University, UK
- Geoff Hall, University of York, UK
- Kim Berg Johannessen, Aarhus University, Denmark
- Tim Jones, University of Worcester, UK
- Fay Julal, University of Southampton, UK
- Minna Lyons, University of Liverpool, UK
- Paul Reavey, London South Bank University, UK
- Tone Roald, University of Copenhagen, Denmark
- Richard Shillcock, University of Edinburgh, UK
- John Song, De Montfort University, UK

- Andrew Stevenson, Manchester Metropolitan University, UK
- Lesley Tranter, University of Reading, UK
- Brady Wagoner, Aalborg University, Denmark

And finally, many thanks to those who gave up their time to appear in a video for the new *Psychology and me* feature:

- Kylie Pascua Leones
- David Crundall
- Sue Sherman
- Tone Roald
- Richard Keegan
- Tanya Byron
- Sharon Buckland
- Angel Chater



Bruce M. Hood

The publisher and authors are grateful to all those who have provided third-party material for this book. All credit lines appear on the page next to the material in question.

# Tour of the book

10

Emotion and motivation

- Emotional experience: the feeling machine
- Are you looking for a fight? Not so sure
- Emotional communication: imgs w/o words
- The real world: That's disgusting!
- Motivation: getting moved
- Money makes you happier psychomythology
- Where do you stand? Taking the guilt trip to confessionland

**Chapter learning objectives**

At the end of this chapter you will be able to:

1. Understand how emotions, feelings and moods differ in their subjective experience, expression and duration.
2. Compare the James-Lange, Cannon-Bard and two-factor theories of emotion, noting their major similarities and differences.
3. Describe two lines of evidence supporting the universality hypothesis for facial expression of emotion and give examples of universal emotional expressions.
4. Describe the differences and connections between emotion and motivation.
5. Describe the difference between intrinsic and extrinsic motivation and conscious and unconscious motivation.

**Why?** This was the question on the British nation's mind in February 1993. What possessed two 10-year-olds boys to abduct a 2-year-old toddler, and then spend the next couple of hours on a four-km walk of torture, cruelty and ultimately death?

Even today, the millions of us who watched the news and saw the video footage from the security cameras of the Bootle Strand shopping centre in Liverpool are still haunted by the abduction. The terrible moment forever frozen in time – 15:42:32 – a shaky blurred image of three boys, the toddler James Bulger being led away, his trusting hand held by Jon Venables, with Robert Thompson in front. By 15:43:08, the three boys had left the shopping centre to begin that appalling journey.

Along the way, James was kicked, punched and tormented. In total, 38 people saw the three boys, and two adults even challenged the older boys about the crying toddler but Thompson and Venables claimed that he was their brother. Eventually, James Bulger was led to a railway track, covered in blue azure model paint and then killed by Thompson and Venables using bricks and an iron bar.

The reporters who turned up in Preston court nine months later had come to discover the reason for James Bulger's torment and murder. They had a duty to report the reasons to their readers but they were to be disappointed. Court hearings are about who, where, when and how. They are not about why. The two boys were being tried in an adult court; carpenters even had to raise the dock by 7.5 cm so that the two boys could see the judge and jury. The prosecution focused on whether the two boys were mature enough to be tried as adults with four specific questions. On the day of the killing, would Thompson and Venables have known the difference between right and wrong? Would they have known that it was wrong to abduct a child? Would they have known that it was wrong to cause injury to a child? Would they know it was wrong to

**Chapter opening vignette**  
 Stories from everyday life or case studies to capture students' attention and preview the topics covered in the chapter.

**Chapter learning objectives**  
 Set out what students should have learned by the end of each chapter and link to central topics in psychology.

**The real world**  
 Applies chapter content to real-world phenomena to emphasize that psychology is about everyday experiences.

hot science

### Control of learning: from the laboratory to the classroom

It's the night before the final exam in your introductory psychology course. You've put in a lot of time reviewing your course notes and the material in this textbook, and you feel that you have learned most of it pretty well. You are coming down the home stretch with little time left, and you've got to decide whether to devote those precious remaining minutes to studying psychological disorders or social psychology. How do you make that decision? What are its potential consequences? Recent research in cognitive psychology has shown that people's judgements about what they have learned play a critical role in guiding further study and learning (Metcalfe, 2009).

An important part of learning involves assessing how well we know something and how much more time we need to devote to studying it. Experimental evidence reveals that these subjective assessments, which psychologists refer to as judgements of learning (JOLs), are related to learning. People typically do better were higher at the end of trial 2 in the 3-1 condition than the 1-3 condition. This illusion occurred because JOLs were influenced by the fact that participants recalled more items in the initial test in the 3-1 condition than in the 1-3 condition (remember, the initial test followed three exposures to the list in the 3-1 condition versus only one exposure to the list in the 1-3 condition).

This manipulation then allowed the experimenters to examine whether JOLs influenced how much time people devoted to each pair when the pairs in the two conditions were learned equally well, even though participants didn't think that they were. Critically, Metcalfe and Finn found evidence for a causal effect: the participants chose to devote more time to studying pairs from the 1-3 condition, which they thought were less well learned, than pairs from the 3-1 condition, which they thought were better learned.

The fact that JOLs have a causal effect on how people study is especially important because – as illustrated by the experiment we just considered – JOLs are sometimes inaccurate. For example, after reading and rereading a chapter or article in preparation for

the real world

### Brain plasticity and sensations in phantom limbs

Long after a limb is amputated, many patients continue to experience sensations where the missing limb would be, a phenomenon called *phantom limb syndrome*. Patients can feel their missing limbs moving, even in coordinated gestures such as shaking hands. Some even report feeling pain in their phantom limbs. Why does this happen? Some evidence suggests that phantom limb syndrome may arise in part because of plasticity in the brain.

Researchers stimulated the skin surface in various regions around the face, torso and arms while monitoring brain activity in amputees and non-amputated volunteers (Ramachandran and Blakeslee, 1998; Ramachandran et al., 1992). Brain-imaging techniques displayed the somatosensory cortical areas activated when the skin was stimulated. This allowed the researchers to map how touch is represented in the somatosensory cortex for different areas of the body. For example, when the face was touched, the researchers could determine which areas in the somatosensory cortex were most active, and when the torso was stimulated, they could see which areas responded, and so on.

Brain scans of the amputees revealed that stimulating areas of the face and upper arm activated an area in the somatosensory cortex that previously would have been activated by a now-missing hand. The face and arm were represented in the somatosensory cortex in an area adjacent to where the person's hand – now amputated – would have been represented. Stimulating the face or arm produced phantom limb sensations in the amputees; they reported 'feeling' a sensation in their missing limbs.

Brain plasticity can explain these results (Pascual-Leone et al., 2005). The cortical representations for the face and the upper arm normally lie on either side of the representation for the hand. The somatosensory areas for the face and upper arm were larger in amputees and had taken over the part of the cortex normally representing the hand. Indeed, the new face and arm

**Hot science**  
 Provides insights into cutting-edge research on the chapter's main topics to show that psychology still has many uncharted territories.

psychomythology

### You only use 10% of your brain

How often have you heard or read that we only use 10% of our brain? Maybe it was an advert for a self-improvement book, or someone claiming to be able to stimulate the untapped resources of the mind. It is so pervasive in society that 30% of US psychology university students (Higbee and Clay, 1998) and 59% of university-educated Brazilian adults have been reported to agree with this claim (Herculano-Houzel, 2002). A recent study of 250 UK schoolchildren found that 70% also thought that you only use this small percentage of your brain (Gjersoe and Hood, 2013).

The origin of the 10% myth is not certain. One candidate is location in the brain where memories were discovered that if you removed large parts were still capable of solving puzzles, suggest one special location. The implication was that all their brain tissue to solve puzzles, it stood were not using all of it.

In this chapter you have learned good re 10% myth. First, brain tissue is metabolically weighs around 2% of the overall body but it average 2,000 calories we need to consume humans evolve a brain that was so expensive use all of it? Second, brain plasticity reveals

**Psychomythology**  
 This brand new feature demonstrates the scientific nature of psychology by dispelling common myths and misconceptions about the discipline, encouraging inquisitive exploration of widely held beliefs.

## Psychology and me

Kylie Pascua Leones, Assistant Psychologist, University College London Hospitals (UCLH)



Kylie Pascua Leones is an Assistant Psychologist at UCLH specializing in neuropsychology. Visit [www.palgrave.com/schacter](http://www.palgrave.com/schacter) to watch Kylie talking about

### Psychology and me

A range of exciting and inspiring video interviews with working psychologists. Summarized on the page, full videos are available on the companion website.

## stats facts

### The dead fish study

A full-length Atlanta salmon lay in the scanner and was asked to determine which emotions people might be experiencing in different social settings shown on the screen. The salmon did not respond because it was a fish after all, and second it was quite dead. Nevertheless, fMRI images of the salmon's head revealed clear activity in the brain region. The purpose of this bizarre study by neuroscientist Craig Bennett and his colleagues (2009) was not simply a joke, but a critical review of the way some fMRI studies might be producing spurious findings based on

### Stats facts

Consider challenges of statistical investigation and offer helpful advice for interpreting quantitative and qualitative data.

of this species' predispositions. This research also helps to explain why some phobias that humans suffer from, such as a fear of heights (acrophobia) or enclosed spaces (claustrophobia), are so common, even in people who have never had unpleasant experiences in these contexts (Mineka and Öhman, 2002). The fears may emerge not from direct conditioning experiences but from observing and learning from the reactions of others.

Observational learning may involve a neural component as well. As you read in chapter 3, *mirror neurons* are a type of cell found in the brains of primates (including humans). Mirror neurons fire when an animal performs an action, such as when a monkey reaches for a food item. More importantly, however, mirror neurons also fire when an animal watches someone *else* perform the same specific task (Rizzolatti and Craighero, 2004). Although this 'someone else' is usually a fellow member of the same species, some

### If only we could model this domestic behaviour at home

Judy, a female chimpanzee, escaped from a US zoo. Before she was recaptured, she was observed entering a bathroom, grabbing a brush and cleaning a toilet. She also wrung out a sponge and cleaned off a refrigerator, according to an Associated Press report. Prior to coming to the zoo, Judy had been a home-reared animal.

Funny-but-true accounts of oddities in human behaviour relating to chapter content.

### Where do you stand?

Encourages critical thinking by asking students to respond to a topic and questions, use their own experiences, and generate defensible arguments and cogent opinions.

### where do you stand?

#### Should horse riding be made illegal?

In 2009, Professor David Nutt, the UK government's chief drug adviser, wrote a provocative editorial for a scientific journal entitled 'Equasy: An overlooked addiction with implications for the current debate on drug harms'. In the article, he highlighted the illogical nature of government drug policy in the UK by comparing the harm of drugs to the risks posed by horse riding in an addiction he called 'equasy', short for 'equine addiction syndrome', a condition characterized by gaining pleasure from horses and being prepared to take the risk of falling off/under the horse.

The UK classifies drugs as A, B, C on the basis of their harmfulness. Ecstasy – a class A drug in the same category as heroin and cocaine – kills around 10–30 individuals each year. However, when you compare the risks between horse riding and taking ecstasy, there is not much difference. You are more likely to come to

horse riding and many more suicides. There are also about 100 traffic deaths each year. Making riding illegal would cost the government a lot of money, but would, in practice, be easy to do.

What about other legal drugs? Alcohol and tobacco are treated as regulated foods, and are consumed by 95% of adults aged 35 and over were estimated to be dependent on alcohol (HSCIC, 2014), and there were 1.2 million people dependent on tobacco in the UK in 2013 (ONS, 2015). Compulsory drug testing for alcohol and tobacco account for less than 2,000 deaths each year.

If potential harm is the basis for drug classification, alcohol and tobacco become class A drugs. Shouldn't horse riding be made illegal? The government should legislate against harmful activities. What do you think? What questions posed by Professor Nutt do you think the government should answer? What do you think the government should do?

## Recommended reading

**Enns, J. T.** (2004) *The Thinking Eye, The Seeing Brain*. New York: Norton. A tour through the visual system, focusing on sensations in the eye and perception in the brain. A fine summary of the key points mentioned in this chapter and a good starting point for branching out to other topics in the science of vision.

**Goodale, M. and Milner, D.** (2004) *Sight Unseen*. Oxford: OUP. This intriguing book explores conscious and unconscious vision. The authors' arguments from studies of brain damage and

neuroscience lead to the proposal of dual systems in visual perception.

**Ward, J.** (2008) *The Frog Who Croaked Blue: Synaesthesia and the Mixing of the Senses*. Hove: Routledge. Written by one of the world's leading experts on synaesthesia, provides a comprehensive and yet accessible state-of-the-art survey of this phenomenon, with a deft mixture of neuroscience and first-person accounts.

## Recommended reading

Identifies key texts for further research and includes accessible trade books, classic texts and modern bestsellers.



# Online ancillaries

## Psychology and me video interviews

These brand new video interviews feature an international range of lecturers, researchers and practitioners talking about their educational and professional experiences in the dynamic field of psychology. Interviewees share their motivations for wanting to study psychology, as well as the areas of the subject they found most enjoyable and most challenging as a student. They also shine a light on the various fascinating career options open to psychology graduates. Researchers offer insights into the hottest studies taking place in the field, while practitioners provide examples of the many exciting applications of a psychology degree. The useful advice and experiences showcased in these videos make them an excellent resource for any student in their current studies and in their future careers as budding psychologists.

We're delighted to feature a diverse group of psychologists, working in different areas, and across the world. All the videos interviews are available on the companion website, [www.palgrave.com/schacter](http://www.palgrave.com/schacter), with accompanying features in relevant chapters, as listed below.

To get started, watch **Bruce Hood**, Professor of Psychology, University of Bristol, and co-author of this book, explaining the idea behind this feature and his own experiences of psychology.



**KYLIE PASCUA LEONES**,  
Assistant Psychologist at University College London Hospitals (Chapter 3, Neuroscience and behaviour)



**DAVID CRUNDALL**,  
Professor of Psychology at Nottingham Trent University, specializing in hazard perception (Chapter 4, Sensation and perception)



**SUE SHERMAN**,  
Senior Lecturer in Psychology at Keele University (Chapter 5, Memory)



**TONE ROALD**,  
Assistant Professor at the University of Copenhagen, Denmark, specializing in consciousness and aesthetic experience (Chapter 8, Consciousness)



**RICHARD KEEGAN**, Assistant Professor of Sport Psychology at the University of Canberra, Australia (Chapter 10, Emotion and motivation)



**TANYA BYRON**, clinician, author, journalist and broadcaster, best known for *Little Angels* and *The House of Tiny Tearaways* (Chapter 12, Social development)



**SHARON BUCKLAND**, rehabilitation coordinator at Headway, a charity for the rehabilitation of people who have suffered from brain injuries (Chapter 16, Psychological disorders)



**ANGEL CHATER**, Lecturer in Behavioural Medicine at University College London (Chapter 17, Mental health)

## Companion website

[www.palgrave.com/schacter](http://www.palgrave.com/schacter)

The fully updated website for the second edition includes a comprehensive suite of learning and teaching materials to aid students and lecturers in completing and delivering psychology courses.

## Learning resources

Students will find a wealth of resources to help check their understanding of the contents of the book and further expand their learning.

Resources include:

- **Psychology and me videos:** a collection of videos filmed specifically for the second edition featuring psychology graduates talking about their current roles as teachers, researchers and practitioners.
- **Access to PsychSim 5.0:** an activity program that places students in simulated research or provides them with dynamic demonstrations illustrating fundamental psychological principles. Students will gain a much deeper understanding of core psychological concepts by engaging in the discipline's classic experiments. The program includes a large number of activities, current research into core concepts, illustrations, animations and video, and dynamic interactive simulations that involve students in the practice of psychological research by having them play the role of experimenter or subject.

- **Interactive multiple choice questions** for each chapter.
- **Video and web assignments:** links to relevant clips and websites along with background information and questions.
- **Discussion topics** to spark debate and further thought.
- **Weblinks** and further reading suggestions to widen knowledge and research.
- **Additional information** on studying psychology, how to use a psychology degree, and careers in the discipline for Scandinavian students.

## Teaching resources

A selection of resources has been carefully commissioned to help lecturers plan and deliver their courses.

These include:

- PowerPoint slides including all the figures and tables from the book.
- An extensive lecturer manual containing:
  - A guide on how to use the media available with the book in lectures and seminars
  - Lecture suggestions
  - Class exercises
  - Essay questions and guideline answers
  - A lecturer testbank containing true/false, multiple choice and essay questions for every chapter.
- Matrices that map chapters onto the BPS and the EFPA syllabus requirements.
- Video clips of classic and more recent experiments and research, linked to each chapter, for use in your teaching.



- Psychology today
- Psychology's roots: the path to a science of mind
- Exporting European psychology
- the real world Improving study skills
- Errors and illusions reveal psychology
- Psychology in the 20th century: behaviourism takes centre stage
- Beyond behaviourism: psychology expands
- **What makes a scientist?** **hot science**
- Beyond the individual: social and cultural perspectives
- The profession of psychology: it's not just common sense
- **Psychology is for girls** **psychomythology**
- where do you stand? The perils of procrastination



## Chapter learning objectives

At the end of this chapter you will be able to:

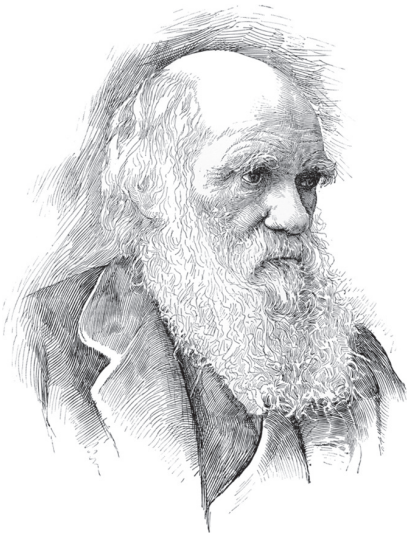
- 1 Explain what is meant by a 'mindbug' and why is it so important to understanding normal psychological functioning.
- 2 Describe the difference between nativism and philosophical empiricism.
- 3 Describe how Darwin's theory of natural selection influenced psychology.
- 4 List the main principles of the behaviourist approach to psychology.
- 5 Explain how Second World War events influenced psychology in the latter half of the 20th century.



# Psychology: the evolution of a science

**A**lan Turing (1912–54) was one of the most influential mathematicians and scientists of the 20th century, who famously helped crack the code of the Nazi's naval indicator system, Enigma, at Bletchley Park, enabling the Allies to intercept enemy communications, which contributed to their success in the Second World War. He was also one of the founders of computer science, developing the concept of machine intelligence by using mathematical formulae with algorithms to perform computations that could mimic human thought processes. Turing reasoned that the brain was essentially a biological computational device and that eventually we would be able to build intelligent machines that were indistinguishable from humans. Such a machine would have to pass what has become known as the 'Turing test'.

There are only a few individuals whose work has not only changed the world in their own lifetime, but also changed the future of our species. In the case of Alan Turing, his ideas played a crucial part in establishing the foundations of the digital revolution that we are still undergoing 60 years after his death. Every computer, every smartphone and even the internet rely on computations and algorithms. In effect, just about every aspect of modern human life owes a debt to Turing. It therefore befits a textbook on psychology to begin by acknowledging his contribution. Psychologists would like to claim him as one of ours because of his influence on how we understand the mind. However, the events of Turing's life also reveal why we are more than just complicated biological machines. In 1945, he was awarded the OBE by King George VI for his wartime services and made a Fellow of the Royal Society in 1951. Sadly, he was convicted of homosexuality the following year, which was illegal at the time and considered to be a mental illness, and lost his status and security clearance. He underwent chemical 'treatment' consisting of oestrogen injections and eventually died in 1954 through cyanide poisoning, which was ruled by the coroner to be an act of suicide.



Darwin's theories of evolution, adaptation and natural selection have provided insight into why brains and minds work the way they do.

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Psychology is not just about computations in the brain. Humans live in complex interdependent groups and share experiences, knowledge and emotions. Our brains are responsible not only for processing the physical nature of the world, but also all the non-physical aspects that are important to our species. Psychology is about people. It is about societies. It is about what is considered 'normal'. It is about feelings. It is about what motivates people to do the things they do. It is even about what would compel one of the 20th-century's most brilliant individuals to take their own life.

A century before Alan Turing, another brilliant thinker had been considering the nature of the human mind. It was no less an intellectual giant than Charles Darwin (1809–82), who predicted in his *On the Origin of Species* (1859, p. 402) that: 'Psychology will be securely based on the foundation ... of the necessary acquirement of each mental power and capacity by gradation. Much light will be thrown on the origin of man and his history.' Darwin's theory of natural selection explained how the diversity of life on earth could arise by the gradual accumulation of features that varied in the population, which were better suited to changing environments. Individuals with these variations were better adapted and so more likely to survive and pass these advantages onto their offspring. Darwin could see no reason to draw a distinction between mechanisms that selected for attributes and behaviours in the animal kingdom and those responsible for the mental faculties found in man.

Darwin's theory of evolution was controversial as it situated humans firmly within the animal kingdom – something that was an affront to most at the time. However, the mid-19th century was a time of turbulent change in the European scientific community. All the major material sciences were witnessing extraordinary upheaval, with new discoveries leading to the development of technologies that would produce a revolution in industry never seen before. Rising among this upheaval was a new science – a science with an origin that could be traced back to the beginnings of human civilization, and yet had remained devoid of data or any notable theory; a science with no obvious technological or industrial associations, whose main focus of inquiry was, instead, central to the notion of what it is to be human. This new science was labelled *psychology* (from a combination of the Greek *psyche*, which means 'soul', and *logos*, which means 'to study'). The word 'psychology' first appeared in the English press in 1853, although psychological issues had preoccupied the earliest thinkers as far back as the classical Greeks. However, psychology could not be considered a 'science' prior to the 19th century because no systematic attempt had been made to pursue or generate the testable hypotheses that were necessary for a field of interest to become a science. Philosophers had pontificated about the nature of the mind but psychology was not yet a science to measure it.

It is not clear why psychology took so long to get started relative to the other sciences. Maybe it was the unobservable workings of the human mind or the lack of suitable methods to measure it, but one major factor was that the inquiry into the nature of what it is to be human bordered dangerously into territory that was deemed to be the prerogative of religion. However, by the 1850s, this territory was increasingly being encroached by scientists searching for ways of measuring and describing the natural world – and the human mind was opened to investigation.

With Darwin's advocacy of psychology, the new science had arrived. But even then, there were many highly educated individuals who resisted the idea that human psychology could be explained and predicted by measureable, lawful processes. Even Alfred Russel Wallace (1823–1913), co-discoverer of natural selection, could not fully commit to the idea as an explanation for all man's faculties. Like Darwin, he agreed that the human body had evolved but that *Homo sapiens* has 'something which he has not derived from his animal progenitors – a spiritual essence or nature ... [that] can only find an explanation in the unseen universe of Spirit'. Wallace could not accept that the complexity of the modern human mind could emerge in the same way as any other evolved biological system, and turned towards spiritualism and notions of the soul. When Wallace published his views in 1869, Darwin wrote to him: 'I differ grievously from you; I can see no necessity for calling in an additional and proximate cause [a supernatural force] in regard to Man ... I hope you have not murdered too completely your own and my child.'

The child Darwin was referring to was the theory of natural selection and it would become the stimulus for the growth of psychology as a new science.

## Psychology today

Shortly after *On the Origin of Species*, Darwin wrote two books that dealt with psychology, *The Descent of Man* (1871) and *The Expression of the Emotions in Man and Animals* ([1872]1998), although despite these books' apparent emphasis on the human, he remained at heart a natural biologist reporting observations. For psychology to really get going as a science, it needed new techniques, measurements and experiments to test hypotheses regarding the mind and behaviour. It was others who followed soon after who picked up Darwin's gauntlet to forge the new science. All across Europe, scientists began to appear with an interest in experimenting on the mind and behaviour. In Germany, there was a strong tradition in experiments to test the responses of the human body to stimulation that would lead to the development of new techniques to measure unconscious processes. In France, there was interest in the faculties of the mind and the effects of certain types of brain damage. In Britain, the measurement of intelligence and individual differences flourished. This spread of psychological inquiry throughout Europe was strong but the scientific study of psychology really took off in the US over the next 150 years. This is reflected in the fact that most psychological research today is still conducted in the US, with an estimated 64% of the world's 56,000 research psychologists operating there (Rosenzweig, 1992). However, an analysis of the top 100 most eminent psychologists of the 20th century reveals that just under 20% are still European (Haggbloom et al., 2002) and we will be covering much of their contribution throughout this textbook.

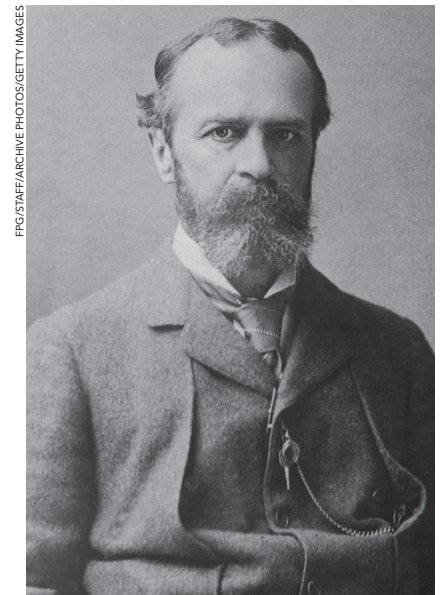
As a profession in Europe, psychology continues to grow in strength. According to the European Federation of Psychologists' Associations (EFPA), 46% of all psychologists practise in Europe, with the 36 member associations of the EFPA representing over 300,000 psychologists in 2014. It is also worth noting that there have been some major divisions between US and European psychology, but they are now becoming more aligned, as evidenced by the recent move to bring diagnostic criteria for clinical disorders in the US more in line with those in the rest of the world. We discuss this in more detail in Chapter 16.

The dominance of psychology in the US is largely due to a handful of pioneers who took the new science to America from Europe. Most prominent of these was William James (1842–1910), who originally studied medicine at Harvard but was so impressed by the new science of psychology he found in Europe that on his return to the US, he finished off his medical degree and changed direction to become the first professor of psychology at Harvard University. *The Principles of Psychology* (James, 1890), his landmark book based on his lectures, was more descriptive than scientific, but in it, James addressed big questions with brilliant insight, which is why it is still widely read and remains one of the most influential books ever written on the subject.

If William James were alive today, he would be amazed by the intellectual advances that have taken place in the science he helped create. Indeed, the sophistication and diversity of modern psychology are nothing short of staggering: psychologists today are exploring perception, memory, creativity, consciousness, love, anxiety, addictions and more. They use state-of-the-art technologies to examine what happens in the brain when people feel anger, recall a past experience, undergo hypnosis, or take an intelligence test. They examine the impact of culture on individuals, the origins and uses of language, the ways in which groups form and dissolve, and the similarities and differences between people from different backgrounds. Their research advances the frontiers of basic knowledge and has practical applications as well – from new treatments for depression and anxiety to new systems that allow organizations to function more effectively.

## Fields of psychological inquiry

**Psychology** is *the scientific study of mind and behaviour*. The **mind** refers to *our private inner experience*, the ever-flowing stream of consciousness that is made up of *perceptions, thoughts, memories and feelings*. **Behaviour** refers to *observable actions of human beings*



William James (1842–1910) was excited by the new field of psychology, which allowed him to apply a scientific approach to age-old questions about the nature of human beings.

**PSYCHOLOGY** The scientific study of mind and behaviour.

**MIND** Our private inner experience of perceptions, thoughts, memories and feelings.

**BEHAVIOUR** Observable actions of human beings and nonhuman animals.



*and nonhuman animals*, the things we do in the world, by ourselves or with others. As you will see in the chapters to come, psychology is an attempt to use scientific methods to address fundamental questions about mind and behaviour that have puzzled people for millennia. The range of research and teaching in psychology today is extensive in a field that is divided broadly into the following areas, which can operate with different methodologies and perspectives:

- *Biological psychology*, sometimes known as ‘biopsychology’, is the study of how biology interacts with psychological processes. It deals with how our bodies influence and respond to events. For example, what happens in our brain when we are experiencing something or how do drugs change thoughts and behaviours?
- *Cognitive psychology* is the study of mental processes. ‘Cognition’ refers to thinking and problem solving. How do we do it? What are the different stages that must be operating when we interpret the world and plan our response to it?
- *Developmental psychology* is the study of how psychological processes change over the life span. As we move through infancy, childhood, adolescence, adulthood and finally become elderly, our bodies obviously change but so do our behaviours and minds. What causes these changes?
- *Individual differences* is the study of how psychological processes vary from one person to the next. How do we measure these differences and why do people differ from each other?
- *Social psychology* is the study of the psychological processes that operate when we interact with others and how we behave in groups. For example, what are the effects of groups on our own individual behaviour and thoughts? How do groups form and what keeps people together?

In order to investigate these key areas, psychologists also need to learn about research methods and design, including skills such as statistical analysis. In this chapter, we will also look at the conceptual issues as well as the historical background to the field. This is because conceptual and historical issues are important to understanding how a field of science emerges and develops. For example, how we conceptualize the nature of human psychology shapes the way we go about investigating it, and as you will discover, there have been different schools of thought about human psychology that have had major impacts on the types of research and theories that have been pursued. Of course, science takes place in context and this is why it is also important to understand the historical events that have helped to shape the field, from the invention of different technologies such as computers to world events such as wars. In each of the chapters of this textbook, we consider how such issues have shaped the field.

The five areas described above represent the major approaches to pursuing psychological issues today. It is best to think about these fields as approaches with overlapping points of interest and content rather than discretely packaged areas as you might find in a warehouse store such as IKEA, where furniture, kitchen, bathroom and bedroom sections are all separately displayed. Rather, the psychological phenomena described in these chapters may be relevant to and explained by more than one approach. For example, memory is often considered a central feature of cognitive psychology but:

- Research into how memory is implemented in the brain is relevant to biological psychology
- The study of how memory changes in children is a developmental issue
- Investigations of the relationship between memory and intelligence address individual differences.

So, core areas of interest can be found in a number of different fields. Similarly, a single finding may be relevant to more than one field. For example, consider the effects of frontal brain damage that we introduce in Chapter 3, where we discuss how patients can become disinhibited and impulsive. This has clear relevance to biological psychology because of the brain structures involved, but it is also relevant to developmental psychology because planning and controlling impulsiveness are important for learning. Some people are naturally more disinhibited and impulsive than others, so the role of the frontal lobes is also relevant to the psychology of individual differences as well as mental

health. Thus, different fields of psychology overlap significantly in terms of the phenomena they describe, but they may come at the same issue from different perspectives. This may seem confusing, but that's because humans are complicated, and psychology has multiple ways of approaching and interpreting the same complex behaviours.

To illustrate these multiple approaches, let us consider a common event such as a fight breaking out in a school playground. Why did one child hit the other? Psychologists coming from different perspectives will focus on different aspects:

- A psychologist with a biological perspective might be interested in the physiology of the event in terms of arousal, impulsiveness or possibly the role of genes and to what extent a child might have inherited a violent disposition from their parents.
- A psychologist interested in individual differences might want to know whether this aggressive behaviour is a stable feature of the child's personality and whether it is related to other aspects.
- A cognitive psychologist might focus on what the children were thinking. Did one perceive the other as a threat or an easy target?
- A developmental psychologist might want to know where this aggressive behaviour came from and how it can be controlled.
- A social psychologist might want to know something about the group influences and effects of aggressive behaviour.

In principle, each of these perspectives could have something to say about fights in the playground, but most students new to psychology want to know which of them is the 'correct' approach. However, all the above are relevant and no one approach is more correct than another. To a new student, this is probably one of the most perplexing aspects of psychology – particularly in comparison to other material sciences such as physics, chemistry or biology, which (at least at first) seem to have much more defined approaches and analysis. It may be frustrating, but the human mind is extraordinarily complex. From the mundane act of tying our shoelaces to the marvel of looking at (or even painting) the *Mona Lisa*, it is psychology that can make headway into discovering why we are what we are and do what we do. Importantly, psychologists also want to understand why the mind occasionally functions so *ineffectively* in the world, causing us to make errors in reasoning and mistakes in judgement or to experience illusions in perception and gaps in memory.

To get a sense of the kinds of questions psychology is interested in, let's consider a few key questions:

- *What are the bases of perceptions, thoughts, memories and feelings, or our subjective sense of self?* For thousands of years, philosophers tried to understand how the objective, physical world of the body was related to the subjective, psychological world of the mind. How could the immaterial mind connect with the material body? Today, psychologists know that there is no magical connection, and no need for one, because all our subjective experiences arise from the electrical and chemical activities of our brains. This is why Darwin believed that natural selection would also explain the evolution of mental faculties: he viewed them simply as a product of the material brain. Our mental lives are nothing more or less than 'how it feels to be a brain'. (Of course, this is a bit like saying that becoming wealthy involves nothing more or less than making money: it makes something sound simple that isn't.)

As you will see throughout this book, some of the most exciting developments in psychological research focus on how our perceptions, thoughts, memories and feelings are related to activity in the brain. Psychologists and neuroscientists now have the capability, using new technologies, to explore this relationship in ways that seek to unravel the link between functions (what the brain does) and structure (how these functions are implemented in the brain's architecture). One technique known as *functional magnetic resonance imaging* (fMRI) allows scientists to 'scan' a brain and see which parts are active when a person reads a word, sees a face, learns a new skill, or remembers a personal



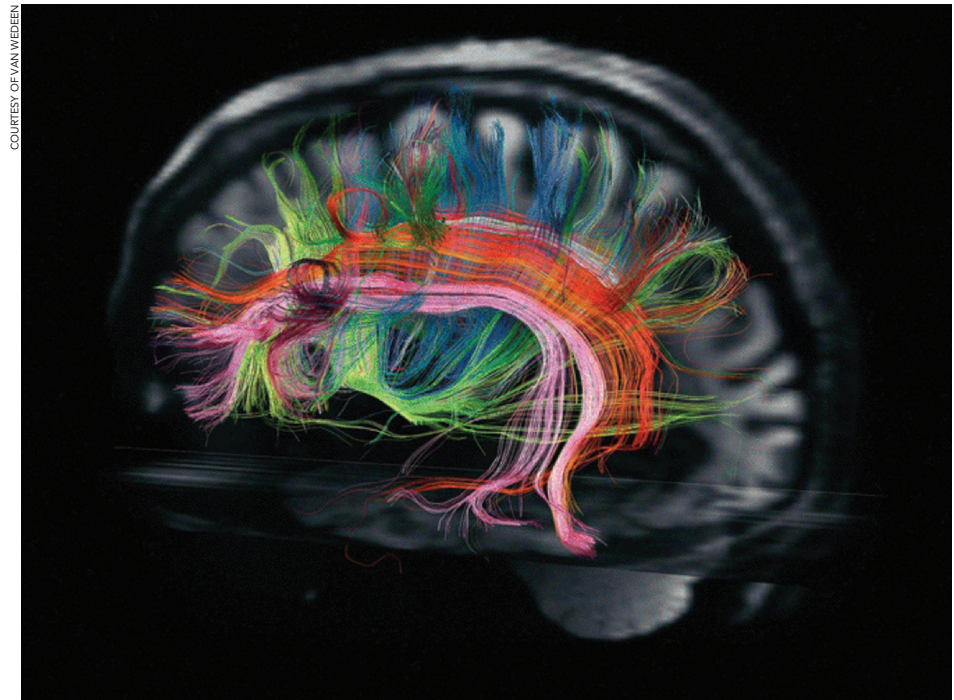
Why does this child want to hit the other? Different psychological perspectives provide different ways to interpret everyday events such as this.

## stats facts

### Of mice and men

One lab has recently published the entire map of the neuronal connections, known as a 'connectome', in the mouse brain (Oh et al., 2014). Although the mouse brain is much smaller than the human brain, its connectome map is 1.8 petabytes of data – enough to fill an HD film that would take 24 years of continuous viewing to watch in its entirety.

Some of the major neural pathways revealed by diffusion tensor imaging (DTI).



COURTESY OF VAN WEDDEEN

experience. *Diffusion tensor imaging* (DTI) enables us to visualize the connections between different brain regions.

In the context of a burgeoning field of new types of neuroimaging, a five-year research programme known as the Human Connectome Project was launched in 2010. This was set up to integrate neuroscience research across 11 institutions based in the US and Europe in order to share the vast amounts of data that imaging studies generate. These new technologies sometimes allow us to answer old psychological questions. In the 19th century, William James was interested in how people acquire complex skills such as the ability to play the violin, and he wondered how the brain enabled great musicians to produce virtuoso performances. What James could only ponder, modern psychologists can discover. For example, the brains of professional and novice pianists were scanned as they made the complex finger movements involved in piano playing, and the results showed that professional pianists have *less* activity than novices in those parts of the brain that guide these finger movements (Krings et al., 2000). This result suggests that extensive practice at the piano changes the brains of professional pianists and the regions controlling finger movements operate more efficiently than they do in novices.

While the new imaging advances promise to deliver an increasingly accurate picture of the brain's microarchitecture, we must remember that having a good wiring diagram is not enough. Imagine opening up a complex machine to take a picture of the internal circuitry. It does not matter how strong your resolution is, you have to know something about what the different components do and how they work together. The same is true of the brain. In the coming chapters, you will learn how imaging studies and related techniques are beginning to transform our understanding of the brain, but that understanding has to be guided by good psychological models so we know what to look for.

- *How does the mind usually allow us to function effectively in the world?* Scientists sometimes say that form follows function, that is, if we want to understand *how* something works, for example an engine or a thermometer, we need to know what it is working *for*, for example powering vehicles or measuring temperature. As James often noted, 'Thinking is for doing': the function of the mind is to help us do those things that sophisticated animals have to do in order to prosper, such as acquiring food, shelter and mates. Psychological processes are said to be *adaptive*, which means that they promote the welfare and reproduction of organisms that engage in those processes.



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The brains of novice pianists are more active than professional pianists. Despite how much you might despise doing your scales, extensive practice trains your brain to be more efficient.

For instance, perception allows us to recognize our families, see predators before they see us, and avoid stumbling into oncoming traffic. Language allows us to organize our thoughts and communicate them to others, which enables us to form social groups and cooperate. Memory allows us to avoid solving the same problems over again every time we encounter them and to keep in mind what we are doing and why. Emotions allow us to react quickly to events that have 'life or death' significance, and they enable us to form strong social bonds. The list goes on and on, and as far as anyone can tell, there is no psychological equivalent of the body's appendix, that is, there's no thoroughly useless mental process that we'd all be better off without.

Given the adaptiveness of psychological processes, it is not surprising that those people with deficiencies in these processes often have a pretty tough time. Neurologist Antonio Damasio (1994) described the case of Elliot, a middle-aged husband and father with a good job, whose life was forever changed when surgeons discovered a tumour in the middle of his brain. The surgeons were able to remove the tumour and save his life, and for a while Elliot seemed just fine. But then odd things began to happen. At first, Elliot seemed more likely than usual to make bad decisions, when he could make decisions at all, and as time went on, his bad decisions became truly dreadful ones. He couldn't prioritize tasks at work because he couldn't decide what to do first, and when he did, he got it wrong. Eventually he was fired, and so he pursued a series of risky business ventures, all of which failed, and he lost his life's savings. His wife divorced him, he married again, and his second wife divorced him too.

So what ruined Elliot's life? The neurologists who tested Elliot were unable to detect any decrease in his cognitive functioning. His intelligence was intact, and his ability to speak, think and solve logical problems was every bit as sharp as it ever was. But as they probed further, they made a startling discovery: Elliot was no longer able to experience emotions. For example, Elliot didn't experience anxiety when he poured his entire bank account into a foolish business venture, he didn't experience any sorrow when his wives packed up and left him, and he didn't experience any regret or anger when his boss showed him the door. Most of us have wished from time to time that we could be as stoic and unflappable as that, after all, who needs anxiety, sorrow, regret and anger? The answer is that we all do. Emotions are adaptive because they function as signals that tell us when we are putting ourselves in harm's way. If you felt no anxiety when you thought about an upcoming exam or about borrowing your friend's car without permission, you would probably make a string of poor decisions that would leave you without a degree and without a friend, except perhaps for your cellmate. Elliot didn't have those feelings, and he paid a big price for it. The ability of a basic psychological process, that is, the experience of emotion, to perform its normally adaptive function was missing in poor Elliot's life.

- *Why does the mind occasionally function so ineffectively in the world?* The mind is an amazing machine that can do a great many things quickly. We can drive a car while talking to a passenger while recognizing the street address while remembering the name of the song that just came on the radio. But like all machines, the mind often trades accuracy for speed and versatility. This can produce 'bugs' in the system, such as when a computer program starts generating unexpected output or gets caught in a loop. Our mental life is just as susceptible to *mindbugs*, occasional malfunctions in our otherwise efficient mental processing. One of the most fascinating aspects of psychology is that we are *all* prone to a variety of errors and illusions. As we will see in later chapters, especially those containing work on perceptual and cognitive illusions, mindbugs reveal that our minds are constrained to process information and generate solutions in particular ways. Indeed, mindbugs offer a window into the internal workings of the mental machinery to reveal the underlying way it may be organized and the limitations under which it can operate. For example, try answering the following question: 'If a bat costs £1 more than a ball and the combined cost of a bat and a ball is £1.10, how much does the bat cost and how much does the ball cost?' Why do most people get this simple sum wrong? The answer is that there is something about the way we reason that gets in the way of us coming up with the



What use are emotions? Sometimes they just entertain us at the cinema, but often they are adaptive and guide us to do what's good for us.