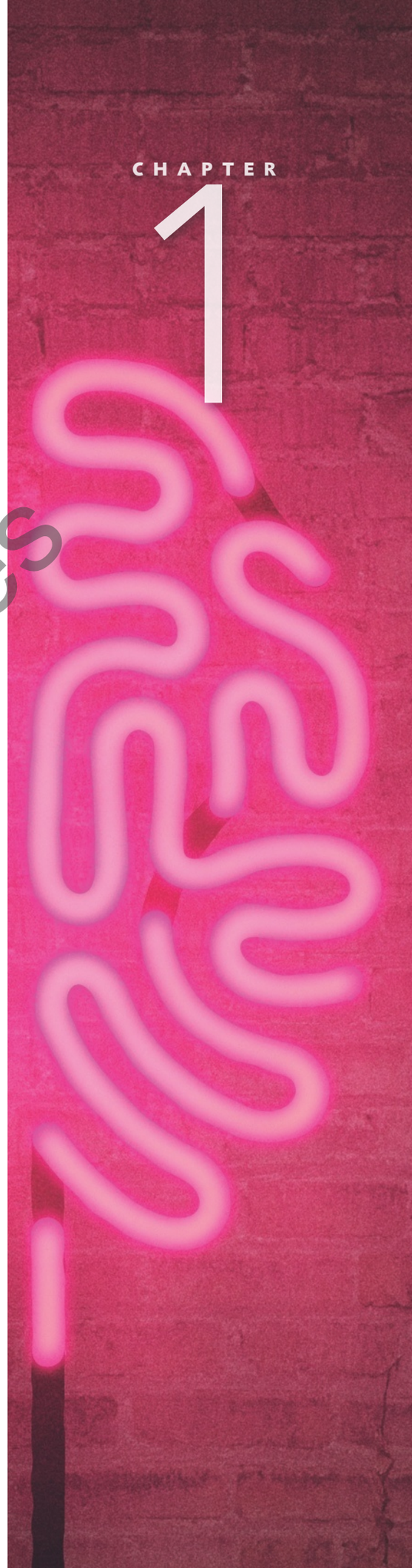
CHAPTER 1

Science and pseudoscience in psychology

SKILLS FOR THINKING SCIENTIFICALLY IN EVERYDAY LIFE

LEARNING OBJECTIVES

1.1a Define psychology.
1.1b Explain the importance of science as a set of safeguards against biases.
1.2a Describe psychological pseudoscience and distinguish it from psychological science.
1.2b Identify reasons we are drawn to pseudoscience.
1.3a Identify the key features of scientific scepticism.
1.3b Identify and explain the text's six principles of scientific thinking.
1.4a Identify the major theoretical frameworks of psychology.
1.4b Describe different types of psychologists and identify what each of them does.
1.4c Describe the two great debates that have shaped the field of psychology.
1.4d Describe how psychological research affects our daily lives.
1.4e Explain how evidence-based practice can help bridge the scientist–practitioner gap.



CHALLENGE YOUR ASSUMPTIONS

- Is psychology different from commonsense?
- Should we trust most self-help books?
- Is psychology a science?
- Are claims that cannot be tested scientific?
- Are all clinical psychologists psychotherapists?

popular psychology industry
sprawling network of everyday sources of information about human behaviour

For most of you reading this book, this is your first or second psychology unit. If you are like most beginning psychology students, much of what you know about psychology comes from watching television programs and movies, listening to talkback radio shows, reading self-help books and popular magazines, surfing the internet and talking to friends. In short, most of your psychology knowledge probably derives from the **popular psychology industry**: a sprawling network of everyday sources of information about human behaviour.

Before reading on, try your hand at this little test of popular psychology knowledge.

TEST OF POPULAR PSYCHOLOGY KNOWLEDGE

1)	Most people use only about 10 per cent of their brain capacity.	True / False
2)	Newborn babies are virtually blind and deaf.	True / False
3)	Hypnosis enhances the accuracy of our memories.	True / False
4)	All people with dyslexia see words backward (like *tac* instead of *cat*).	True / False
5)	In general, it is better to express anger than to hold it in.	True / False
6)	The lie-detector (polygraph) test is 90–95 per cent accurate at detecting falsehoods.	True / False
7)	People tend to be romantically attracted to individuals who are opposite from them in personality and attitudes.	True / False
8)	The more people present at an emergency, the more likely it is that at least one of them will help.	True / False
9)	People with schizophrenia have more than one personality.	True / False
10)	All effective psychotherapies require clients to get to the root of their problems in childhood.	True / False

Beginning psychology students typically assume that they know the answers to most of the preceding questions. That is hardly surprising, as these assertions have become part of popular psychology lore. Yet most students are surprised to learn that *all* 10 of these statements are false! This little exercise illustrates a take-home message we will emphasise throughout the text: *although commonsense can be enormously useful for some purposes, it is sometimes completely wrong* (Chabris & Simons, 2010; Watts, 2014). This can be especially true in psychology, a field that strikes many of us as self-evident, even obvious. In a sense, we are *all* psychologists, because we deal with psychological phenomena such as love, friendship, anger, stress, happiness, sleep, memory and language in our daily lives (Lilienfeld, Ammirati & Landfield, 2009). As we will discover, everyday experience can often be helpful in allowing us to navigate the psychological world, but it does not necessarily make us an expert (Kahneman & Klein, 2009). Put a bit differently, familiarity with human nature does not equal understanding of human nature (Lilienfeld, 2012).

Stop and think

Were you surprised by the results of this quiz? Where do you recall learning about the myths that you thought were true? Why do you think many of these myths persist despite scientific evidence to the contrary?

1.1 What is psychology? Science versus intuition

1.1a Define psychology.

1.1b Explain the importance of science as a set of safeguards against biases.

William James (1842–1910), one of the great pioneers in psychology, once described psychology as a 'nasty little subject'. As James noted, psychology is difficult to study, and simple explanations of behaviour are few and far between. If you enrolled in this unit expecting cut-and-dried answers to psychological questions, such as why you become angry or fall in love, you might emerge disappointed. But if you enrolled in the hopes of acquiring more insight

into the hows and whys of human behaviour, read on. Be prepared, however, to find many of your preconceptions about psychology challenged; to encounter new ways of thinking about the causes of your everyday thoughts, feelings and actions; and to apply these ways of thinking to evaluating psychological claims in everyday life.

Psychology and levels of analysis

The first question often posed in introductory psychology textbooks could hardly seem simpler: What is psychology? Although psychologists disagree about many things, they agree on one thing: psychology is not easy to define (Henriques, 2004; Lilienfeld, 2004). In part, that is because psychology is a vast discipline, encompassing the study of perceptions, emotions, thoughts and observable behaviours from an enormous array of perspectives. For the purposes of this text, though, we will simply refer to **psychology** as the scientific study of the mind, brain and behaviour.

psychology
the study of the mind, brain and behaviour

Psychology is a discipline that spans multiple **levels of analysis**. We can think of levels of analysis as rungs on a ladder, with the lower rungs tied most closely to biological influences and the higher rungs tied most closely to social influences (Ilardi & Feldman, 2001; Kendler, 2005; Schwartz, Lilienfeld, Meca & Sauvigné, 2016). The levels of analysis examined in psychology stretch all the way from what psychologists call 'neurons to neighbourhoods'; that is, they span molecules to brain structures on the lower rungs to thoughts, feelings and emotions and to social and cultural influences on the higher rungs, with many levels in between (Cacioppo, Berntson, Sheridan & McClintock, 2000; Satel & Lilienfeld, 2013) (see Figure 1.1). The lower rungs are more closely tied to what we traditionally call 'the brain'; the higher rungs to what we traditionally call 'the mind'. It is crucial to understand that 'brain' and 'mind' can be complementary ways of describing and analysing the same underlying psychological processes. Although psychologists may choose to investigate different rungs, they are united by a shared commitment to understanding the causes of human and animal behaviour.

levels of analysis
rungs on a ladder of analysis, with lower levels tied most closely to biological influences and higher levels tied most closely to social influences

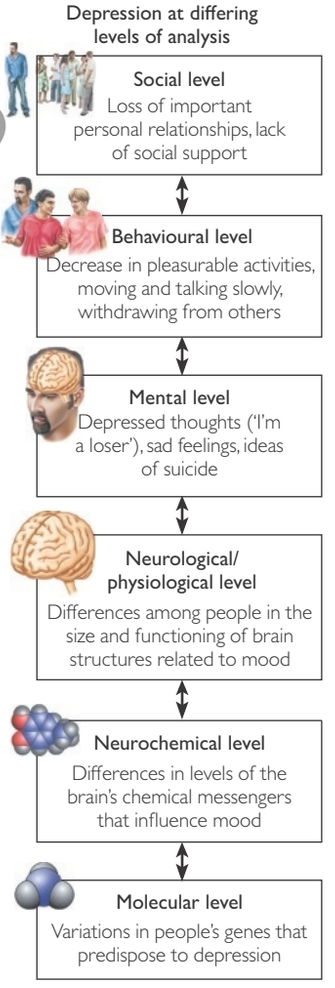


Figure 1.1 Levels of analysis in depression. We can view psychological phenomena, in this case the disorder of depression, at multiple levels of analysis, with lower levels being more biological and higher levels being more social. Each level provides unique information and offers a distinctive view of the phenomenon at hand. (*Source:* Based on data from Ilardi, Rand & Karwoski, 2007.)

We will cover all of these levels of analysis in coming chapters. When doing so, we will keep one crucial guideline in mind: *to fully understand psychology, we must consider multiple levels of analysis*. That is because each level tells us something different, and we gain new knowledge from each vantage point. Think of viewing a major city from the vantage point of a tall hotel's glass elevator (Watson, Clark & Harkness, 1994). As you ascend, you will obtain different glimpses of the city. At the lower elevations, you will acquire a better grasp of the details of the city's roads, bridges and buildings, whereas at the higher elevations, you will acquire a deeper perspective of how the roads, bridges and buildings fit together and interact. Each elevation tells you something new and interesting. The same is true when ascending the ladder of levels of analysis in psychology.

It is easy to fall into the trap of assuming that only one level of analysis is the *right* or best one. Some psychologists believe that biological factors—like the actions of the brain and its billions of neurons (nerve cells)—are sufficient for understanding the major causes of behaviour. Others believe that social factors—like parenting practices, peer influences and culture—are sufficient for understanding the major causes of behaviour (Meehl, 1972). This text will steer clear of these two extremes, because both biological and social factors are essential for a complete understanding of psychology (Kendler, 2005; Schwartz et al., 2016).

What makes psychology distinctive—and fascinating

A key theme of this textbook is that we can approach psychological questions scientifically, in a similar way to how we approach questions in biology, chemistry or physics. Yet in some ways, psychology is distinctive from other sciences, if not unique. A host of challenges make the study of mind, brain and behaviour especially complex; yet it is precisely these challenges that also make psychology fascinating because they contribute to scientific mysteries that psychologists have yet to solve. Here, we will touch briefly on five especially intriguing challenges that we will be revisiting throughout the text.

First, human behaviour is difficult to predict, in part because almost all actions are **multiply determined**—that is, they are produced by many factors. That is why we need to be sceptical of *single-variable explanations* of behaviour, which are widespread in popular psychology. Although it is tempting to explain complex human behaviours like violence in

multiply determined
caused by many factors

Psychology may not be a traditional hard science like chemistry, but many of its fundamental questions are even more difficult to answer.

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anorexia nervosa
psychiatric condition marked by extreme weight loss and the perception that one is overweight even when one is massively underweight

individual differences
variations among people in their thinking, emotion and behaviour

In the museum of everyday life, causation is not a one-way street. In conversations, one person influences a second person, who in turn influences the first person, who in turn influences the second person, and so on. This principle, called *reciprocal determinism*, makes it challenging to pinpoint the causes of behaviour.

Henry Westheim Photography/Alamy Stock Photo

terms of a single causal factor such as poverty, bad upbringing or genes, these behaviours are almost surely due to the interplay of an enormous array of such factors (Stern, 2002).

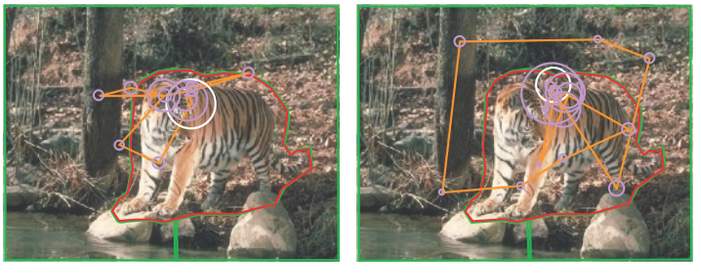
Second, psychological influences are rarely independent of each other, making it difficult to pin down which cause or causes are operating. Imagine you are a scientist attempting to explain why some women develop **anorexia nervosa**. You could start by identifying several factors that might contribute to anorexia nervosa, such as anxiety-proneness, compulsive exercise, perfectionism and exposure to television programs that feature thin models. Say that you want to focus on just one of these potential influences, such as perfectionism. Here is the problem: women who are perfectionists also tend to be anxious, to exercise a lot, to watch television programs that feature thin models, and so on (Egan et al., 2013). The fact that all of these factors tend to be interrelated makes it tricky to pinpoint which one actually contributes to anorexia nervosa. The odds are high that they all play at least some role.

Third, people differ from each other in thinking, emotion, personality and behaviour. These **individual differences** help to explain why each person responds in different ways to the same objective situation, such as an insulting comment from a boss (Harkness & Lilienfeld, 1997). In this respect, psychology is far more complicated than chemistry because people—unlike most carbon atoms—are not identical. Entire fields of psychology, such as the study of intelligence, interests, personality and mental illness, focus on individual differences (Cooper, 2015a, 2015b; Lubinski, 2000). Individual differences make psychology challenging because they make it difficult to come up with explanations of behaviour that apply to everyone; at the same time, they make psychology exciting because people we might assume we understand well often surprise us in their reactions to life events.

Fourth, people often influence each other, making it difficult to pin down what causes what (Wachtel, 1973). For example, if you are an extraverted person, you are likely to make the people around you more outgoing. In turn, their outgoing behaviour may '*feed back*' to make you even more extraverted, and so on. This is an example of what Albert Bandura (1973) called *reciprocal determinism*—the fact that we mutually influence each other's behaviour. Reciprocal determinism can make it challenging to isolate the causes of human behaviour (Wardell & Read, 2013).

Fifth, people's behaviour is often shaped by culture. Cultural differences, such as individual differences, place limits on the generalisations that psychologists can draw about human nature (Henrich, Heine & Norenzayan, 2010; Morris, Chiu & Lui, 2015). To take one example, Richard Nisbett and his colleagues found that European Americans and Asian Americans often pay attention to strikingly different things in pictures (Chua, Boland & Nisbett, 2005). In one case, the researchers showed people a photograph of a tiger walking on rocks next to a river. Using eye-tracking technology, which allows researchers to determine where people are moving their eyes, they found that European Americans tend to look mostly at the tiger, whereas Asian Americans tend to look mostly at the plants and rocks surrounding it. This finding dovetails with evidence that European Americans tend to focus on central details, whereas Asian Americans tend to focus on peripheral or incidental details (Nisbett, 2003; Nisbett, Peng, Choi & Norenzayan, 2001).

All five of these challenges are worth bearing in mind as we move on to later chapters. The good news is that psychologists have made substantial progress towards solving all of them, and that a deeper and richer appreciation of these challenges helps us to better predict—and in some cases understand—behaviour.



In a study by Chua, Boland and Nisbett (2005), European Americans tended to focus more on the central details of photographs, like the tiger itself (*left*), whereas Asian Americans tended to focus more on the peripheral details, like the rocks and leaves surrounding the tiger (*right*).

Hannah Faye Chua; Stuart Ramson/AP Images

Why we cannot always trust our commonsense

To understand why others act as they do, most of us trust our commonsense—our gut intuitions about how the social world works. Yet, as we have already discovered, our intuitive understanding of ourselves and the world is frequently mistaken (Cacioppo, 2004; van Hecke, 2007).

As the quiz at the start of this chapter showed us, sometimes our commonsensical understanding of psychology is not merely incorrect but entirely backwards. For example, although many people believe the old adage 'There's safety in numbers', psychological research actually shows

that the more people there are present at an emergency, the *less* likely it is that at least one of them will help (Darley & Latané, 1968; Latané & Nida, 1981).

Here is another illustration of why we cannot always trust our commonsense. Read the following 10 well-known proverbs, most of which deal with human behaviour, and ask yourself whether you agree with them.

1. Birds of a feather flock together.	6. Opposites attract.
2. Absence makes the heart grow fonder.	7. Out of sight, out of mind.
3. Better safe than sorry.	8. Nothing ventured, nothing gained.
4. Two heads are better than one.	9. Too many cooks spoil the broth.
5. Actions speak louder than words.	10. The pen is mightier than the sword.

While these proverbs may all ring true, each one contradicts the proverb across from it. So commonsense can lead us to believe two things that cannot both be true simultaneously, or at least that are largely at odds with each other. Strangely enough, in most cases we never notice the contradictions until other people point them out to us. This example reminds us of why scientific psychology does not rely exclusively on intuition, speculation or commonsense.

Figure 1.2 Naive realism can fool us. Even though our perceptions are often accurate, we cannot always trust them to provide us with an error-free picture of the world. In this case, take a look at Shepard's tables, courtesy of psychologist Roger Shepard (1990). Believe it or not, the tops of these tables are identical in size: one can be directly superimposed on top of the other.

NAIVE REALISM: SEEING IS BELIEVING—OR IS IT? We trust our commonsense largely because we are prone to **naive realism**: the belief that we see the world precisely as it is (Lilienfeld, Lohr & Olatunji, 2008; Ross & Ward, 1996). We assume that 'seeing is believing' and trust our intuitive perceptions of the world and ourselves. In daily life, naive realism often serves us well. If you are driving down an outback dirt track and see a B-double barrelling towards you at 120 kilometres per hour, it is a wise idea to get out of the way. Much of the time, we *should* trust our perceptions.

naive realism
belief that we see the world precisely as it is

Yet appearances can sometimes be deceiving. The earth *seems* flat. The sun *seems* to revolve around the earth (see Figure 1.2 for another example of deceptive appearances). However, in both cases, our intuitions are wrong.

Sometimes, what appears to be obvious can trip us up when it comes to evaluating ourselves and others. Our commonsense assures us that people who do not share our political views are biased but that we are objective. Yet psychological research demonstrates that just about all of us tend to evaluate political issues in a biased fashion (Pronin, Gilovich & Ross, 2004). So our tendencies towards naive realism can lead us to draw incorrect conclusions about human nature. In many cases, 'believing is seeing' rather than the reverse: our beliefs shape our perceptions of the world (Gilovich, 1991; Gilovich & Ross, 2016).

Here is another case in which our naive realism can trick us. Take a look at these two upside-down photos. They look quite similar, if not identical. Now turn your book upside-down.
Warren Goldswain/Shutterstock

WHEN OUR COMMONSENSE IS RIGHT. That is not to say that our commonsense is always wrong. Our intuition comes in handy in many situations, and sometimes guides us to the truth (Gigerenzer, 2007; Gladwell, 2005; Myers, 2002). For example, our snap (five-second) judgments about whether someone we have just watched on a video is trustworthy or untrustworthy tend to be right more often than would be expected by chance (Fowler, Lilienfeld & Patrick, 2007). Commonsense can also be a helpful guide for generating hypotheses that scientists can later test in rigorous investigations (Redding, 1998). Moreover, some everyday psychological notions are indeed correct. For example, most people believe that happy employees tend to be more productive on the job than unhappy employees, and research indicates that they are right (Kluger & Tikochinsky, 2001).

But to think scientifically, we must learn when—and when not—to accept our commonsense conclusions. Doing so will help us to become more informed consumers of popular psychology and, ideally, to make better real-world decisions. One major goal of this text is to provide you with a framework of scientific thinking tools for doing so. This thinking framework can help you to better evaluate psychological claims, not just in your courses, but in everyday life.

Psychology as a science

A few years ago, one of our academic colleagues was advising a psychology major about his career plans. Out of curiosity, our colleague asked him, 'So why did you decide to go into

psychology?'. He responded, 'Well, I took a lot of science courses and realised I didn't like science, so I picked psychology instead'.

We hope to persuade you that this student was wrong—not about selecting a psychology major, but about psychology not being a science. A central theme of this text is that modern psychology, or at least hefty chunks of it, is scientific. But what does the word '*science*' really mean, anyway?

Most students think that 'science' is just a word for all of that really complicated stuff they learn in their biology, chemistry and physics classes. But science is not a body of knowledge; instead, it is an approach to evidence and explanations of the world around and in us (Bunge, 1998; Chalmers, 2013). Specifically, science consists of a set of attitudes and skills designed to prevent us from fooling ourselves and others. It begins with *empiricism*, the attitude that knowledge about the world should be acquired through observation of the things in the world. Yet such observation can only be a rough starting point for psychological knowledge. As the phenomenon of naive realism reminds us, observation is not sufficient by itself because our senses can fool us. Science refines our initial observations, subjecting them to stringent tests to determine whether they are accurate. Those interpretations of our observations that stand up to rigorous scrutiny are retained, while those that do not are revised or discarded.

A large percentage, perhaps even the majority, of the general public doubts that psychology is scientific (Ferguson, 2015; Janda, England, Lovejoy & Drury, 1998; Lilienfeld, 2012). Some of this scepticism probably reflects the fact that few psychologists who appear on the news or other popular media outlets are scientists. So it is hardly surprising that, in a representative survey, only 30 per cent agreed that 'psychology attempts to understand the way people behave through scientific research'; in contrast, 52 per cent believed that 'psychology attempts to understand the way people behave by talking to them and asking them why they do what they do' (Penn & Schoen and Berland Associates, 2008, p. 29). In fact, scientific psychologists almost always rely on systematic research methods, of which talking to people is only one component, and often not the most important.

Another reason why many people question psychology's scientific status is that psychology is intimately familiar to all of us: memory, learning, love, sleep, personality and the like are part and parcel of everyday lives. Because these psychological phenomena are so recognisable to us, we may assume that we understand them (Lilienfeld, 2012). Indeed, children and adults alike tend to regard psychology as simpler and more self-evident than physics, chemistry and biology (Keil, Lockhart & Schlegel, 2010), which probably helps to explain why these other fields are often called the 'hard' sciences. Yet as you will see in later chapters, there are many ways in which psychology is even 'harder' than physics because behaviour—especially human behaviour—is often far more challenging to predict (Cesario, 2014; Meehl, 1978).

WHAT IS SCIENTIFIC THEORY?

Few terms in science have generated more confusion than the deceptively simple term *theory*. Some of this confusion has contributed to serious misunderstandings about how science works. We will first examine what a scientific theory is, and then address two misconceptions that show what a scientific theory is not.

scientific theory
explanation for a large number of findings in the natural world

A **scientific theory** is an explanation for a large number of findings in the natural world, including the psychological world. A scientific theory offers an account that ties multiple findings together into one conceptual package.

hypothesis
testable prediction derived from a theory

But good scientific theories do more than account for existing data. They generate predictions regarding new data we have not yet observed. For a theory to be scientific, it must generate novel predictions that researchers can test. Scientists call a testable prediction a **hypothesis**. In other words, theories are general explanations, whereas hypotheses are specific predictions derived from those explanations (Bolles, 1962; Meehl, 1967). Based on their tests of hypotheses, scientists can provisionally accept the theory that generated these hypotheses, reject the theory outright or revise it (Proctor & Capaldi, 2006). Now, let us consider two common misconceptions about what a theory is.

Misconception 1: *A theory explains one specific event*. The first misunderstanding is that a theory is a specific explanation for an event. The media get this distinction wrong much of the time. We often hear television reporters say something like, 'The most likely theory for the robbery at the bank is that it was committed by two former bank employees dressed up as armed guards'. But this is not a 'theory' of the robbery. For one thing, it

attempts to explain only one event rather than a variety of diverse observations and, for another, it does not generate testable predictions.

Misconception 2: *A theory is just an educated guess.* A second myth is that a scientific theory is merely a guess about how the world works. People often dismiss a theoretical explanation on these grounds, arguing that it is 'just a theory'.

In fact, *all* general scientific explanations about how the world works are theories. A few theories are extremely well supported by multiple lines of evidence; for example, the Big Bang theory, which proposes that the universe we see today began in a gigantic explosion about 14 billion years ago, helps scientists to explain a diverse array of observations. They include the findings that: (1) galaxies are rushing away from each other at remarkable speeds; (2) the universe exhibits a background radiation suggestive of the remnants of a tremendous explosion; and (3) powerful telescopes reveal that the oldest galaxies originated shortly after 14 billion years ago, right around the time predicted by the Big Bang theory. Like all scientific theories, the Big Bang theory can never be 'proved' because it is always conceivable that a better explanation might come along one day. Nevertheless, because this theory is consistent with many differing lines of evidence, the overwhelming majority of scientists accept it as a good explanation. Darwinian evolution, the Big Bang and other well-established theories are not just guesses about how the world works because very many of their predictions have been substantiated over and over again by independent investigators. In contrast, many other scientific theories are only moderately well supported, and still others are questionable or entirely discredited. Not all theories are created equal.

So, when we hear that a scientific explanation is 'just a theory', we should remember that theories are not just guesses. Some theories have survived repeated efforts to test them and are well-confirmed models of how the world works (Kitcher, 2009).

IDENTIFY THEORIES AND HYPOTHESES

1) Sarah's motivation for cheating was fear of failure.
   a. Theory b. Hypothesis
2) Darwin's evolutionary model explains the changes in species over time.
   a. Theory b. Hypothesis
3) The universe began in a gigantic explosion about 14 billion years ago.
   a. Theory b. Hypothesis
4) Our motivation to help a stranger in need is influenced by the number of people present.
   a. Theory b. Hypothesis
5) Crime rates in Brisbane increase as the temperature rises.
   a. Theory b. Hypothesis

1) b, 2) a, 3) a, 4) b, 5) b.

Fact or fiction?

Academic psychologists are more sceptical of many weakly supported claims, such as extrasensory perception, than are their colleagues in more traditional sciences, such as physics and chemistry.

(See end of chapter for answer.)

SCIENCE AS A SAFEGUARD AGAINST BIAS: PROTECTING US FROM OURSELVES. Some people assume that because scientists strive for objective knowledge, scientists themselves are free of biases. Yet scientists, including psychological scientists, are only human and so they have their biases too (Mahoney & DeMonbreun, 1977). The best scientists, though, try to be aware of their biases and try to find ways of compensating for them. In particular, the best scientists realise that they *want* their pet theories to be correct. After all, they have invested months or even years in designing and running a study to test a theory, sometimes a theory they have developed. If the results of the study are negative, they will often be bitterly

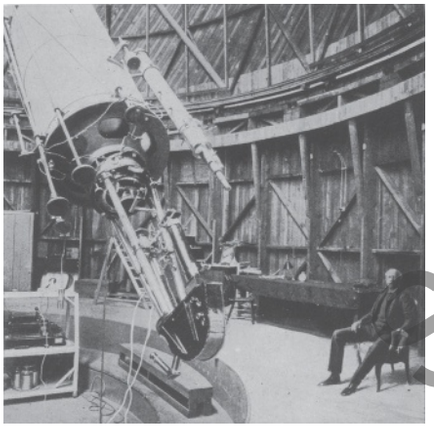
Here are four cards. Each of them has a letter on one side and a number on the other side. Two of these cards are shown with the letter side up, and two with the number side up.

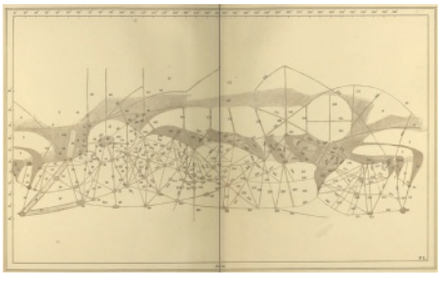
Indicate which of these cards you have to turn over in order to determine whether the following claim is true:

If a card has a vowel on one side, then it has an odd number on the other side.

Figure 1.3 Diagram of Wason selection task. In the Wason selection task, you must pick two cards to test the hypothesis that all cards that have a vowel on one side have an odd number on the other. Which two will you select?

confirmation bias
tendency to seek out evidence that supports our beliefs and neglect or distort evidence that contradicts them





Top, Astronomer Percival Lowell sits next to his telescope. *Bottom*, one of Lowell's sketches of his Martian 'canals', which he erroneously believed to provide evidence of extraterrestrial intelligence. Lowell's observations almost surely stemmed in part from confirmation bias.

(top) Chronie/Alamy Stock; (bottom) Wikimedia Commons/Public Domain

disappointed. They also know that because of this deep personal investment, they may bias the results unintentionally to obtain the ones they want (Greenwald, Pratkanis, Leippe & Baumgardner, 1986).

Scientists are prone to self-deception, just like the rest of us. As a consequence, there are several traps into which scientists can fall unless they are careful. We will discuss two of the most crucial next.

Confirmation bias. To protect themselves against bias, good scientists adopt procedural safeguards against errors, especially errors that could work in their favour. In other words, scientific methods are tools for overcoming **confirmation bias**—the tendency to seek out evidence that supports our beliefs and to deny, dismiss or distort evidence that contradicts them (Nickerson, 1998; Risen & Gilovich, 2007). We can sum up confirmation bias in five words: *Seek and ye shall find*.

Because of confirmation bias, our preconceptions often lead us to focus on evidence that bolsters our beliefs, resulting in psychological tunnel vision (Wagenmakers, Wetzels, Borsboom, van der Maas & Kievit, 2012). One of the simplest demonstrations of confirmation bias comes from research on the Wason selection task, one example of which is displayed in Figure 1.3 (Wason, 1966). There, you will see four cards, each of which has a number on one side and a letter on the other side. Your task is to determine whether the following hypothesis is correct: all cards that have a vowel on one side have an odd number on the other side. To test this hypothesis, you need to select two cards to turn over. Which two will you pick? Decide on the answer before reading on.

Most people pick the cards showing E and 5. If you selected E, you were right; but if you also selected 5, you have fallen prey to confirmation bias, although you would be in good company because most people make this mistake. Although 5 seems to be a correct choice, it can only confirm the hypothesis, not disconfirm it. Think of it this way: if there is a vowel on the other side of the 5 card, this does not rule out the possibility that the 4 card has a vowel on the other side, which would disconfirm the hypothesis. So the 4 card is actually the other card to turn over, as that is the only other card that could disconfirm the hypothesis.

Confirmation bias would not be especially interesting if it were limited to cards with numbers and letters. What makes confirmation bias so important is that it extends to many areas of daily life, including friendship, romance and politics (Nickerson, 1998; Rassin, Eerland & Kuijpers, 2010). It also helps to account for how scientists, even brilliant ones, can be led astray. Percival Lowell (1855–1916), an influential American astronomer, was renowned for his keen powers of observation. Today, though, he is perhaps best known for falling prey to what may have been the most prolonged visual illusion in scientific history. Around the turn of the twentieth century, Lowell became convinced that he had discovered dozens of canals on Mars, which he believed provided definitive evidence of intelligent life on the Red Planet. Using his powerful telescope, he 'observed' these canals for decades and 'discovered' more and more of them over time (Sagan & Fox, 1975).

What had happened? Several decades before, an Italian astronomer had detected similar features on the Martian surface and referred to them as *canali*. The astronomer actually was not sure what to make of them, but because canali became translated into English as canals, Lowell and others assumed that they were likely the products of an extraterrestrial civilisation. Interestingly, not long before Lowell starting 'seeing' his canals, the Suez Canal had been built in Egypt, so the idea of canals was very much a topic of discussion in popular culture. So, almost certainly, Lowell was psychologically predisposed to perceive canals on Mars, and sure enough he did. He was a victim of confirmation bias. Remarkably, it was not until the 1960s, when robot missions were sent to photograph the Martian surface, that the idea of Martian canals was disconfirmed.

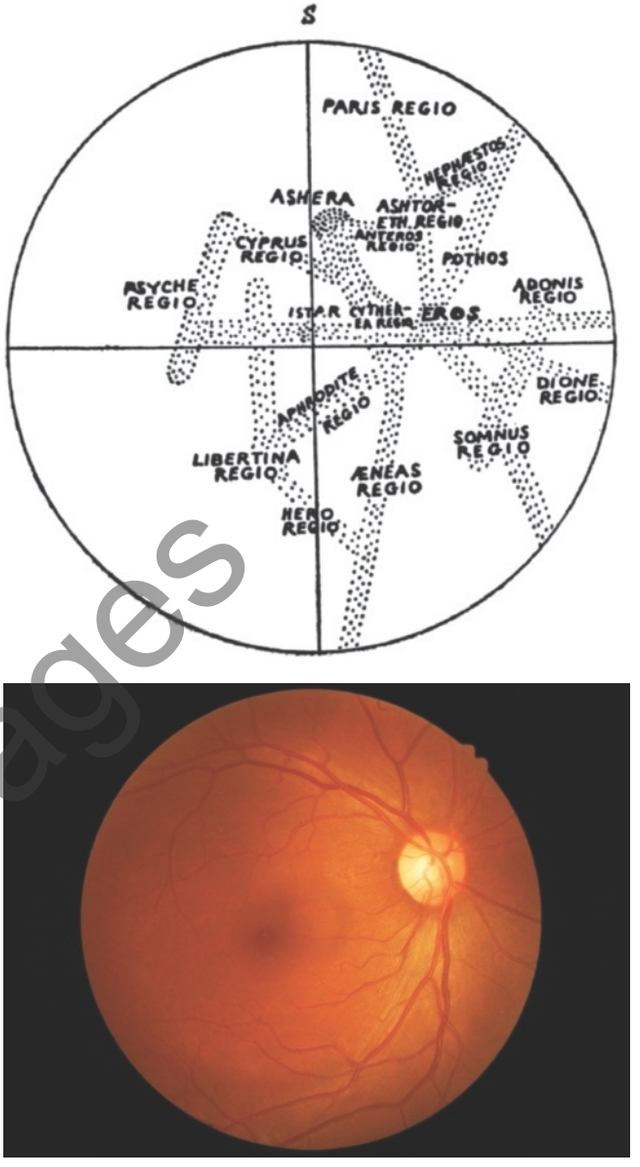
As it turns out, there is a curious postscript to this story. Although it is less well known, Lowell also claimed to observe 'spokes' on the surface of Venus; we now know this was impossible because the surface of Venus is not visible from earth. In 2003, however, a research team noticed that Lowell's spokes on Venus bore a striking similarity to the blood vessels in the human eye (Sheehan & Dobbins, 2003). Moreover, because of the peculiar construction of his telescope, Lowell was probably seeing his eye faintly reflected in his line of vision. So Lowell was probably mistaking planetary canals and spokes for the blood vessels in the back of his own eye!

Although you will be encountering a variety of biases in this text, we can think of confirmation bias as the 'mother of all biases'. That is because it is the bias that can most easily fool us into seeing what we want to see (Gilovich & Ross, 2016). For that reason, it is also the most crucial bias that scientists need to counteract. What distinguishes scientists from non-scientists is that the former adopt systematic safeguards to protect against confirmation bias, whereas the latter do not (Lilienfeld, Ammirati & Landfield, 2009; MacCoun & Perlmutter, 2016).

Belief perseverance: it is my story and I am sticking to it. Confirmation bias can predispose us to another shortcoming to which we are all prone: **belief perseverance**. In everyday language, belief perseverance is the 'do not confuse me with the facts' effect. Because none of us wants to believe we are wrong, we are usually reluctant to give up our cherished notions. For example, even though numerous widely publicised studies have shown that vaccines do not cause autism (technically called *autism spectrum disorder*), one in three parents continues to believe that they do (Nyhan & Reifler, 2015).

In one striking demonstration of belief perseverance, Lee Ross and his colleagues asked students to inspect 50 suicide notes and determine which were genuine and which were fake (in reality, half were genuine, half fake). They then gave the students feedback on how well they did. Unbeknownst to the students, this feedback bore no relation to their actual performance. Instead, the researchers randomly told some students that they were good at detecting real suicide notes and others that they were bad at it. Even after investigators told the students that their feedback was completely fake—which it was—the students based their estimates of ability on the feedback they had received. That is, students told that they were good at detecting real suicide notes were convinced that they were better at it than those students told that they were bad at it. In contrast to the second group of students, the first group even predicted they would do well on a similar task in the future (Ross, Lepper & Hubbard, 1975).

Beliefs endure. Even when informed we are wrong, we do not completely wipe our mental slates clean and start from scratch.



Top, The 'spokes' on Venus observed by Percival Lowell. *Bottom*, Blood vessels in the human eye. Do you notice a similarity? One author team did (Sheehan & Dobbins, 2003).

(top) Photo Researchers, Inc/Alamy Stock Photo; (bottom) memorisz/Shutterstock

The boundaries of science

It is essential to distinguish pseudoscience (claims that pretend to be science) from the **non-scientific knowledge** that comes from domains of inquiry which lie outside the scope of science. Disciplines such as mathematics, ethics, history, art, music, literature, poetry, religion, law and politics (to name some key examples) pursue vital questions that are not addressed by the methods of science. These fields have developed their own critical methods suited to pursue their particular aims. That is not to say that science has nothing to contribute to inquiry in these domains—far from it. But it is to say that there are important questions that are not resolvable within science. Take, for example, the question: 'Why is there something rather than nothing?'. Or consider this statement: *the desire for hope is an entirely legitimate human need which must be respected*. Is this true or false? How will you decide this by scientific experiments? There are many important questions that lie outside the scope of science. However, psychology is a discipline that seeks to understand that which can be known about the human condition through the methods of scientific inquiry.

belief perseverance
tendency to stick to our initial beliefs even when evidence contradicts them

non-scientific knowledge
assertions about aspects of reality that are not experimentally testable

Recognising that we might be wrong

Good scientists are keenly aware that they might be mistaken (Sagan, 1995; Tavris & Aronson, 2007). This is a crucial insight because initial scientific conclusions are often wrong, with medical findings being prime examples (Prasad & Cifu, 2015). Eating a lot of chocolate reduces your risk for heart disease; oops, no, not true. Drinking a little red wine is good for you; no, actually, it is bad for you. And on and on it goes. Ioannidis (2005) even found that about a third of findings from published medical studies do not hold up in later studies. But the beauty of this

admittedly messy process is that scientific knowledge is almost always tentative and potentially open to revision. The fact that science is a process of continually revising and updating findings is not a source of weakness; instead, science's capacity for self-correction actually lends it strength as a method of inquiry. It does mean, though, that we usually acquire knowledge about the world slowly and in small bits and pieces.

One way of characterising this process is to describe science, including psychological science, as a prescription for humility (Firestein, 2015; McFall, 1997). Good scientists do not claim to *prove* their theories and try to avoid committing to definitive conclusions unless the evidence for them is overwhelming. Such terms and phrases as *suggests*, *appears* and *raises the possibility that* are widespread in scientific writing and allow scientists to remain tentative in their interpretations of findings. Many beginning students understandably find this all a bit frustrating; they may wonder: 'But what I am supposed to believe?'. Yet, as Carl Sagan (1995) observed, the best scientists hear a little voice in their heads that keeps repeating the same words: 'I might be wrong'. Science forces us to question our findings and conclusions and encourages us to ferret out mistakes in our belief systems (O'Donohue, Lilienfeld & Fowler, 2007). Science also forces us to attend to data that are not to our liking, whether or not we want to. As Tavris and Aronson (2007) observed, science is a method of 'arrogance control'. It helps to keep us honest.

1.2 Psychological pseudoscience: imposters of science

1.2a Describe the features of psychological pseudoscience and distinguish it from psychological science.

1.2b Identify reasons we are drawn to pseudoscience.

Of course, you might have enrolled in this course to understand yourself, your friends or a boyfriend or girlfriend. If so, you might well be thinking, 'But I don't want to become a scientist. In fact, I'm not even interested in research. I just want to understand people'.

Actually, we are not trying to persuade you to become a scientist. Instead, our goal is to persuade you to *think scientifically*: to become aware of your biases and to avail yourself of some of the methods scientists use to try to overcome them. In this way, you will become better at making educated choices in your everyday life, like what weight loss plan to choose, what psychotherapy to recommend to a friend or even what potential romantic partner is a better long-term bet. Not everyone can become a scientist, but just about everyone can learn to think like one.

The amazing growth of popular psychology

The popular psychology industry is expanding rapidly. On the positive side, this means that the Australian public has unprecedented access to psychological knowledge. On the negative side, the remarkable growth of popular psychology has led not only to an information explosion but also to a *misinformation explosion* because there is scant quality control over what this industry produces.

Subliminal self-help tapes supposedly influence behaviour by means of messages delivered to the unconscious. But do they really work?

To take just one example, about 3500 self-help books are published every year (Arkowitz & Lilienfeld, 2006), although only a handful are written or even screened by scientific experts. Investigators have found some of these books to be effective for treating depression, anxiety and other psychological problems, but about 95 per cent of all self-help books describe methods that have never been examined in research studies (Gould & Clum, 1993; Gregory, Canning, Lee & Wise, 2004; Rosen, 1993) and evidence suggests that a few of them may even worsen people's psychological problems (Haeffel, 2010; Rosen, 1993; Salerno, 2005). And although some self-help books contain high-quality and scientifically supported information, others are misleading or even dangerous. For example, some of these books encourage readers who suspect they might have been sexually abused in childhood to try hard to 'remember' the abuse. Yet this procedure may increase many readers' risk for false memories of abuse (McConkey & Sheehan, 1995).

Coinciding with the rapid expansion of the popular psychology industry is the enormous growth of treatments and products that purport to cure almost every imaginable psychological ailment. There are more than 500 'brands' of psychotherapy (Eisner, 2000), with new ones emerging every year. Fortunately, research shows that some of these treatments are clearly helpful for depression, anxiety disorders, eating disorders, sleep difficulties and a host of

Table 1.1 Some websites for scientific psychology and mental health

ORGANISATION	URL
Association for the Scientific Study of Consciousness	http://theassc.org
Australasian Neuroscience Society	www.ans.org.au
Australasian Society for Psychophysiology	www.asp.org.au
Australian Association for Cognitive and Behaviour Therapy	www.aacbt.org.au
Australian Psychoanalytical Society	www.psychoanalysis.asn.au
Australian Psychological Society	www.psychology.org.au
Australian Society of Hypnosis	www.hypnosisaustralia.org.au
Brain Foundation (Australia)	http://brainfoundation.org.au
Koestler Parapsychology Unit	www.koestler-parapsychology.psy.ed.ac.uk
Project Air	www.projectairstrategy.org/
Psychology Tools	https://psychologytools.com/
Society for Personality and Social Psychology	www.spsp.org
Society of Clinical Psychology	www.psychology.sunysb.edu/eklonsky-/division12
Scientific Review of Mental Health Practice	www.srmhp.org

other psychological problems. Yet the substantial majority of psychotherapies remain untested, so we do not know whether they help (Baker, McFall & Shoham, 2009). Some may even be harmful (Lilienfeld, 2007).

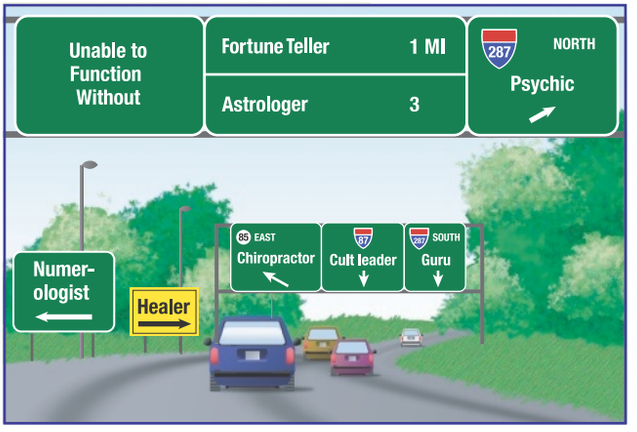
Fortunately, not all psychology information in popular culture is inaccurate. For example, some self-help books base their recommendations on solid research about psychological problems and their treatment. We can often find excellent articles and programs in Australian and international media outlets that present high-quality information regarding the science of psychology. In addition, hundreds of websites provide remarkably helpful information and advice concerning a host of psychological topics, like memory, personality testing, and psychological disorders and their treatment (see Table 1.1). In contrast, many other websites contain misleading or erroneous information, so we need to be armed with accurate knowledge to evaluate them.

What is pseudoscience?

pseudoscience
set of claims that seems scientific but is not

Everything discussed thus far highlights a crucial point: we need to distinguish claims that are genuinely scientific from those that are merely imposters of science. An imposter of science is a **pseudoscience**: a set of claims that seems scientific but is not. In particular, *pseudoscience lacks the safeguards against confirmation bias and belief perseverance that characterise science.*

Pseudoscientific and other questionable beliefs are widespread. A 2009 survey of the US public shows that 25 per cent believe in astrology, 26 per cent believe that trees and other objects possess magical energies and 15 per cent have consulted psychics (Pew Research Center, 2009). The fact that many Americans entertain the possibility of such phenomena is not, by itself, worrying because a certain amount of open-mindedness is essential for scientific thinking. What is troubling, however, is that so many Americans appear convinced that such phenomena exist even though the scientific evidence for them is weak, as in the case of psychics, or essentially non-existent, as in the case of astrology. It is even more troubling that many poorly supported beliefs are more popular, or at least more widespread, than well-supported beliefs; for example, there are about 20 times as many astrologers as astronomers in the United States (Gilovich, 1991); as a



Pseudoscientific and otherwise questionable claims have increasingly altered the landscape of modern life.

Table 1.2 Some warning signs that can help us recognise pseudoscience

SIGN OF PSEUDOSCIENCE	EXAMPLE
Overuse of ad hoc immunising hypotheses	The psychic who claimed to predict the future failed all controlled tests in the lab, but said it was because the experimenters inhibited his extrasensory powers.
Exaggerated claims	Three simple steps will change your love life forever!
Over-reliance on anecdotes	This woman practised yoga daily for three weeks and has not had a day of depression since.
Absence of connectivity to other research	Amazing new innovations in research have shown that eye massage results in reading speeds 10 times faster than average!
Lack of review by other scholars (called 'peer review') or replication by independent labs	Fifty studies conducted by the company all show overwhelming success!
Lack of self-correction when contrary evidence is published	Although some scientists say that we use almost all our brains, we have found a way to harness additional brain power previously undiscovered.
Meaningless 'psychobabble' that uses fancy scientific-sounding terms that do not make sense	Sine-wave filtered auditory stimulation is carefully designed to encourage maximal orbitofrontal dendritic development.
Talk of 'proof' instead of 'evidence'	Our new program is proven to reduce social anxiety by at least 50 per cent!

consequence, the general public may often have a difficult time distinguishing accurate from inaccurate claims regarding astronomy. The same principle holds for psychology.

WARNING SIGNS OF PSEUDOSCIENCE. Numerous warning signs can help us distinguish science from pseudoscience; we have listed some of the most useful ones in Table 1.2. They are extremely helpful rules of thumb, so useful in fact that we will draw on many of them in later chapters to help us become more informed consumers of psychological claims. We can—and should—also use them in everyday life. None of these signs is by itself proof positive that a set of claims is pseudoscientific. Nevertheless, the more of these signs we see, the more sceptical of these claims we should become.

Here, we will discuss three of the most crucial of these warning signs.

Overuse of ad hoc immunising hypotheses. This is not quite as complicated as it appears, because an **ad hoc immunising hypothesis** is just an escape hatch that defenders of a theory use to protect their theory from being disproven.

ad hoc immunising hypothesis
escape hatch or loophole that defenders of a theory use to protect their theory from being contradicted by evidence

When proponents of a theory come across negative evidence, they often try to explain it away by invoking loopholes (excuses for the negative results). Sometimes these excuses can be shown to be correct, but in other cases excuses are simply added upon excuses until there is no longer any possibility for evidence to contradict the theory. For example, some psychics have claimed to perform remarkable feats of **extrasensory perception (ESP)** in the real world, such as reading others' minds or forecasting the future. But when brought into the laboratory and tested under tightly controlled conditions, most have bombed, performing no better than chance. Some of these psychics and their proponents have invoked an ad hoc immunising hypothesis to explain away these failures: the sceptical attitudes of the experimenters are somehow interfering with psychic powers (Carroll, 2003; Lilienfeld, 1999). Although this hypothesis is not necessarily wrong, it makes the psychics' claims essentially impossible to test. In such cases, good scientists will seek to test the ad hoc hypothesis itself, but the continuing addition of ad hoc hypotheses can render any theory immune to scientific tests (Lakatos, 1974).

extrasensory perception (ESP)
perception of events outside the known channels of sensation

Lack of self-correction. As you have learned, many scientific claims turn out to be wrong. Fortunately, in science, incorrect claims tend to be weeded out eventually, even though it often takes a while. In contrast, in most pseudosciences, mistaken assertions never seem to go away because their proponents fall prey to belief perseverance, clinging to them stubbornly despite contrary evidence. Moreover, pseudoscientific claims are rarely updated in light of new data. Most forms of astrology have remained almost identical for about 4000 years (Hines, 2003) despite the discovery of outer planets in the solar system (Uranus and Neptune) that were unknown in ancient times.

Over-reliance on anecdotes. There is an old saying that 'the plural of anecdote isn't fact' (Park, 2003). A mountain of numerous anecdotes may seem impressive, but it should not persuade us to put much stock in others' claims. Anecdotes are 'I know a person who' assertions (Nisbett & Ross, 1980; Stanovich, 2012). This kind of second-hand evidence—'I know a person who says his self-esteem skyrocketed after receiving hypnosis', 'I know a person who tried to commit suicide after taking an antidepressant'—is commonplace in everyday life. Anecdotes should not be confused with first-hand reports such as, 'I felt less depressed after taking this herbal remedy'. First-hand reports are a basic form of evidence often dealt with in the law courts and by historians. These fields have their own critical standards for assessing the credibility of such reports.

Pseudosciences tend to rely heavily on anecdotal evidence. In many cases, they base claims on the dramatic reports of one or two individuals: 'I lost 15 kilos in three weeks on the Matzo Ball Soup Weight-loss Program'. Compelling as this anecdote may appear, it does not constitute good scientific evidence (Davison & Lazarus, 2007; Loftus & Guyer, 2002). For one thing, anecdotes do not tell us anything about cause and effect. Maybe the Matzo Ball Soup Weight-loss Program caused the person to lose 15 kilos, but maybe other factors were responsible. Perhaps he went on an additional diet or started to exercise frantically during that time. Or perhaps he underwent drastic weight-loss surgery during this time but failed to mention it. Anecdotes also cannot tell us anything about how representative the cases are. Perhaps most people who went on the Matzo Ball Soup Weight-Loss Program gained weight, but we never heard from them. Finally, anecdotes are often difficult to verify. Do we really know for sure that he lost 15 kilos? We are taking his word for it, which is a risky idea.

Simply put, most anecdotes are extremely difficult to interpret as evidence. As clinical psychologist Paul Meehl (1995) put it: 'The clear message of history is that the anecdotal method delivers both wheat and chaff, but it does not enable us to tell which is which' (p. 1019).

WHY ARE WE DRAWN TO PSEUDOSCIENCE? There are a host of reasons why so many of us are drawn to pseudoscientific beliefs. Perhaps the central reason stems from the way our brains work. *Our brains are predisposed to make order out of disorder and find sense in nonsense.* This tendency is generally adaptive, as it helps us to simplify the often bewildering world in which we live (Alcock, 1995; Pinker, 1997; Shermer, 2011). Without it, we would be constantly overwhelmed by endless streams of information we do not have the time or ability to process. Yet this adaptive tendency can sometimes lead us astray because it can cause us to perceive meaningful patterns even when they are not there (Carroll, 2003; Davis, 2009).

Stop and think

Do you know someone who believes in a conspiracy theory? What is it and what evidence is consistent with this theory? What evidence is inconsistent with it?

A final reflection of patternicity is our tendency to see meaningful images in meaningless visual stimuli. If you have looked at a cloud and perceived the vague shape of an animal, you have experienced this version of patternicity, as has any of us who has seen the oddly misshapen face of a 'man' in the moon. Another entertaining example comes from the photograph in Figure 1.4a. In 1976, the *Mars Viking Orbiter* snapped an image of a set of features on the Martian surface that bore an eerie resemblance to a human face. So eerie, in fact, that some individuals maintained that the 'Face on Mars' offered conclusive proof of intelligent life on the Red Planet (Hoagland, 1987). In 2001, during a mission of a different spacecraft, the *Mars Global Surveyor*, the National Aeronautics and Space Administration (NASA) decided to adopt a scientific approach to the face on Mars. NASA was open-minded but demanded evidence. It swooped down much closer to the face and pointed the *Surveyor*'s cameras directly at it. If you look at Figure 1.4b, you can see what NASA found: absolutely nothing. The patternicity in this instance was a consequence of a peculiar configuration of rocks and shadows present at the angle at which the photographs were taken in 1976, a camera artefact in the original photograph that just happened to place a black dot where a nostril should be, and

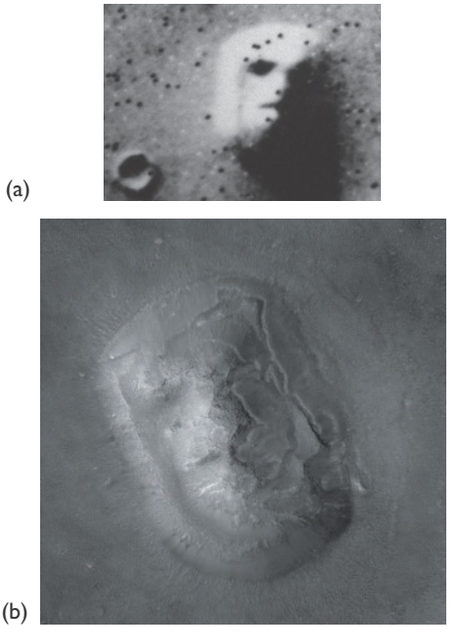


Figure 1.4 Face on Mars. At the top *(a)* is the remarkable 'Face on Mars' photo taken by the *Mars Viking Orbiter* in 1976. Some argued that this face provided proof of intelligent life on other planets. Below *(b)* is a more detailed photograph of the Face on Mars taken in 2001 that revealed that this 'face' was just an illusion.

(*Source:* NASA/courtesy of nasaimages.org.)

mysteries of **psychological science**

Why do we perceive patterns even when they do not exist?

Our tendency to see patterns in meaningless data is so profound that one science writer, Michael Shermer (2008), gave it a name: **patternicity**. Although patternicity can lead to errors, it probably stems from an evolutionarily adaptive tendency (Reich, 2010). If we eat a specific food, say a bacon and egg sandwich, for lunch tomorrow and become violently ill soon afterwards, we will tend to avoid bacon and egg sandwiches for a while. We will do so even though there is a very good chance that the link between the sandwich and our becoming ill was purely coincidental. No matter—our brains tend to seek out patterns and connections between events because of a basic evolutionary principle: 'better safe than sorry'. All things being equal, it is usually better to assume that a connection between two events exists than to assume that it does not, especially when one of the events is physically dangerous.

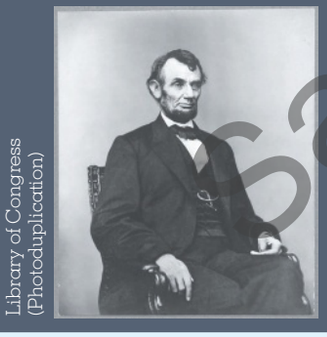
We all fall prey to patternicity from time to time (Hood, 2014). If we think of a friend with whom we have not spoken in a few months and immediately afterwards receive a telephone call from him or her, we may jump to the conclusion that this striking co-occurrence stems from ESP. Well, it *might*. But it is also entirely possible, if not likely, that these two events happened at about the same time by chance alone. For a moment, think of the number of times one of your old friends comes to mind and then think of the number of phone calls you receive each month. You will realise that the laws of probability make it likely that at least once over the next few years, you will be thinking of an old friend at about the same time he or she calls.

Another manifestation of patternicity is our tendency to detect eerie coincidences between persons or events. To take one example, read through each of the uncanny similarities between Abraham Lincoln and John F. Kennedy, two American presidents who were the victims of assassination, listed in Table 1.3.

Pretty amazing stuff? So extraordinary, that some writers have argued that Lincoln and Kennedy are somehow linked by supernatural forces (Leavy, 1992). In actuality, though, coincidences are everywhere and they are surprisingly easy to detect if we make the effort to look for them. Because of patternicity, we may attribute paranormal significance to coincidences that are a result of chance.

Moreover, we often fall victim to confirmation bias and neglect to consider evidence that does not support our hypothesis. Because we typically find coincidences to be far more interesting than non-coincidences, we tend to forget, for example, that Lincoln was a Republican whereas Kennedy was a Democrat; that Lincoln was shot in Washington, DC whereas Kennedy was shot in Dallas; and that Lincoln had a beard, but Kennedy did not. Recall that scientific thinking is designed to counteract confirmation bias. To do so, we must seek out evidence that contradicts our ideas. In extreme forms, patternicity leads us to embrace conspiracy theories, in which individuals detect supposedly hidden connections between numerous largely or entirely unrelated events (Douglas & Sutton, 2011).

Table 1.3 Some eerie commonalities between Abraham Lincoln and John F. Kennedy

Abraham Lincoln	John F. Kennedy
 Library of Congress (Photoduplication)	 World History Archive/Alamy Stock Photo
Was elected to Congress in 1846	Was elected to Congress in 1946
Was elected President in 1860	Was elected President in 1960
The name 'Lincoln' contains seven letters	The name 'Kennedy' contains seven letters
Was assassinated on a Friday	Was assassinated on a Friday
Lincoln's secretary, named Kennedy, warned him not to go to the theatre, where he was shot	Kennedy's secretary, named Lincoln, warned him not to go to Dallas, where he was shot
Lincoln's wife was sitting beside him when he was shot	Kennedy's wife was sitting beside him when he was shot
John Wilkes Booth (Lincoln's assassin) was born in 1839	Lee Harvey Oswald (Kennedy's assassin) was born in 1939
Was succeeded by a president named Johnson	Was succeeded by a president named Johnson
Andrew Johnson, who succeeded Lincoln, was born in 1808	Lyndon Johnson, who succeeded Kennedy, was born in 1908
Booth fled from a theatre to a warehouse	Oswald fled from a warehouse to a theatre
Booth was killed before his trial	Oswald was killed before his trial

perhaps most important, our innate tendency to perceive meaningful faces in what are basically random visual stimuli.

Conspiracy theories can lead us to believe two logically inconsistent things at the same time.
(See end of chapter for answer.)

Fact or fiction?

Finding comfort in our beliefs. Another reason for the popularity of pseudoscience is motivational: we believe in part because we want to believe. As the old saying goes, 'hope springs eternal'. Many pseudoscientific claims, such as astrology, may give us comfort because they seem to offer us a sense of control over an often unpredictable world (Shermer, 2002). Research suggests that we are especially prone to patternicity when we experience a loss of control over our surroundings. Jennifer Whitson and Adam Galinsky (2008) deprived some participants of a sense of control—for example, by having them try to solve an unsolvable puzzle or recall a life experience in which they lacked control—and found that they were more likely than other participants to perceive conspiracies, embrace superstitious beliefs and detect patterns in meaningless visual stimuli (see Figure 1.5). These results may help to explain why so many of us believe in astrology, ESP and other belief systems that claim to foretell the future: they lend us a sense of control over the uncontrollable (Wang, Whitson & Menon, 2012).

According to **terror management theory**, our awareness of our own inevitable death leaves many of us with an underlying sense of fear (Solomon, Greenberg & Pyszczynski, 2000; Vail et al., 2010). We cope with these feelings of terror, advocates of this theory propose, by adopting cultural worldviews that reassure us that our lives possess a broader meaning and purpose—one that extends well beyond our fleetingly brief existence on this planet.

Can terror management theory help to explain the popularity of certain paranormal beliefs, such as astrology, ESP and communication with the dead? Perhaps. widespread beliefs in life after death and reincarnation may stem in part from the terror that stems from knowing we will eventually die (Lindeman, 1998; Norenzayan & Hansen, 2006; Whitson, Galinsky & Kay, 2015). Two researchers (Morier & Podlipentseva, 1997) found that compared with other participants, those who were asked to contemplate death reported higher levels of beliefs in the paranormal, such as ESP, ghosts, reincarnation and astrology, than did other participants. It is likely that such beliefs are comforting to many of us, especially when confronted with reminders of our demise, because they imply the existence of a dimension beyond our own.

Terror management theory does not demonstrate that paranormal claims are false; we still need to evaluate these claims on their own merits. Nonetheless, this theory suggests that we are likely to hold many paranormal beliefs regardless of whether they are correct.

patternicity
the tendency to perceive meaningful patterns in their absence

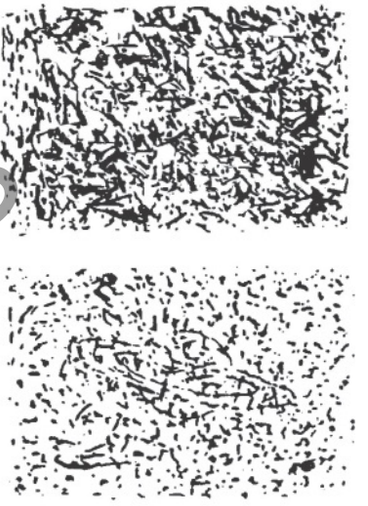


Figure 1.5 Regaining control. Do you see an image in either of these pictures? Participants in Whitson and Galinsky's (2008) study who were deprived of a sense of control were more likely than other participants to see images in both pictures, even though only the picture on the bottom contains an image (a faint drawing of the planet Saturn).

terror management theory
theory proposing that our awareness of our death leaves us with an underlying sense of terror with which we cope by adopting reassuring cultural worldviews

THINKING CLEARLY: AN ANTIDOTE AGAINST PSEUDOSCIENCE. Both to avoid being seduced by the charms of pseudoscience and simply to do good science, we must learn to avoid commonplace pitfalls in reasoning. Students new to psychology commonly fall prey to *logical fallacies*: traps in thinking that can lead to mistaken conclusions. It is easy for us to make these errors, because they seem to make intuitive sense. We should remember that scientific thinking often requires us to cast aside our beloved intuitions, although doing so can be extremely difficult.

Here we will examine three especially important logical fallacies that are essential to bear in mind when evaluating psychological claims. Learning to avoid these and other logical fallacies (see Table 1.4) takes considerable time and effort. To do so, you must unlearn deeply entrenched habits of thinking. Nevertheless, if you bear these fallacies in mind when evaluating scientific evidence, you will find yourself becoming a better critical thinker in everyday life.

Emotional reasoning fallacy. 'The idea that childcare might have negative emotional effects on children gets me really upset, so I refuse to believe it.'

The *emotional reasoning fallacy* is the error of using our emotions as guides for evaluating the validity of a claim (some psychologists also refer to this error as the *affect heuristic*; Kahneman, 2011; Slovic & Peters, 2006). If we are honest with ourselves, we will realise that findings that challenge our pre-existing beliefs often make us angry, whereas findings that

Table 1.4 Other logical fallacies to remember when evaluating psychological claims

NAME	DEFINITION	EXAMPLE OF THE FALLACY
Appeal to authority fallacy	Error of accepting a claim merely because an authority figure endorses it	'My professor says that psychotherapy is worthless; because I trust my professor, she must be right.'
Genetic fallacy	Error of confusing the correctness of a belief with its origins (genesis)	'Freud's views about personality development cannot be right because Freud's thinking was shaped by sexist views popular at the time.'
Argument from antiquity fallacy	Error of assuming that a belief must be valid just because it has been around a long time	'There must be something to the Rorschach Inkblot Test because psychologists have been using it for decades.'
Argument from adverse consequences fallacy	Error of confusing the validity of an idea with its potential real-world consequences	'IQ cannot be influenced by genetic factors because if that were true it would give the government an excuse to prevent low-IQ individuals from reproducing.'
Appeal to ignorance fallacy	Error of assuming that a claim must be true because no one has shown it to be false	'No scientist has been able to explain away every reported case of ESP, so ESP probably exists.'
Naturalistic fallacy	Error of inferring a moral judgment from a scientific fact	'Evolutionary psychologists say that sexual infidelity is a product of natural selection. Therefore, sexual infidelity is ethically justifiable.'
Hasty generalisation fallacy	Error of drawing a conclusion on the basis of insufficient evidence	'All three people I know who are severely depressed had strict fathers, so severe depression is clearly associated with having a strict father.'
Circular reasoning fallacy	Error of basing a claim on the same claim reworded in slightly different terms	'Dr Smith's theory of personality is the best because it seems to have the most evidence supporting it.'

confirm these beliefs often make us happy or at least relieved. We should not, however, make the mistake of assuming that because a scientific claim makes us feel uncomfortable or indignant, it must be wrong. In the case of scientific questions concerning the psychological effects of childcare, which are scientifically controversial (Belsky, 1988; Hunt, 1999), we need to keep an open mind to the data, regardless of whether they confirm or disconfirm our preconceptions.

Bandwagon fallacy. 'A lot of people I know believe in astrology, so there's got to be something to it.'

The *bandwagon fallacy* is the error of assuming that a claim is correct just because many people believe it. It is an error, because popular opinion is not a dependable guide to the accuracy of an assertion. Before 1500, almost everyone believed the sun revolved around the Earth, rather than vice versa, but they were woefully mistaken.

Not me fallacy. 'My psychology professor keeps talking about how the scientific method is important for overcoming biases. But these biases do not apply to me, because I am objective.'

The *not me fallacy* is the error of believing that we are immune from errors in thinking that afflict other people. This fallacy can lead us to conclude mistakenly that we do not require the safeguards of the scientific method. When scientists fall into this trap (as proponents on both sides of the global warming debate have claimed about each other), they join the ranks of the pseudoscientists. They become so certain that their claims are right—and uncontaminated by mistakes in their thinking—that they do not bother to conduct scientific studies to back up their claims.

Social psychologists have recently uncovered a fascinating phenomenon called the *bias blind spot*, which means that most people are unaware of their biases but are keenly aware of them in others (Pronin, Gilovich & Ross, 2004; Ross, Ehrlinger & Gilovich, 2015). None of us believes we have an accent because we live with our accent all of the time. Similarly, few of us believe we have biases because we have grown accustomed to seeing the world through our own psychological lenses. To see the not me fallacy at work, watch a debate between two intelligent people who hold extremely polarised views on a political issue. More likely than not, you will see that the debate participants are quite adept at pointing out biases in their opponents, but are often oblivious of their own equally glaring biases. People who are highly intelligent are just as prone to bias blind spot as are other people (West, Meserve & Stanovich, 2012), so we should never assume that more knowledge, education or sophistication makes us immune to this error.

Candace Newmaker was a tragic victim of a pseudoscientific treatment called rebirthing therapy. She died of suffocation at age 10 after her therapists wrapped her in a flannel blanket and squeezed her to simulate birth contractions.

AP Photo

The dangers of pseudoscience: why should we care?

Up to this point, we have been talking a lot about pseudoscience. Why? Pseudoscience can be dangerous, even deadly. This point applies to a variety of questionable claims that we encounter in everyday life. There are three major reasons why we should all be concerned about pseudoscience.

1. *Opportunity costs: what we give up*. Pseudoscientific treatments for mental disorders can lead people to forgo effective treatments (Lazar, 2010), a phenomenon known as *opportunity costs*. As a consequence of opportunity costs, even treatments that are themselves harmless can cause harm indirectly by causing people to forfeit the chance to obtain a treatment that works. For example, a major community survey (Kessler et al., 2001) revealed that people with histories of severe depression or anxiety attacks more often received scientifically unsupported treatments than scientifically supported treatments like cognitive-behavioural therapy. Such unsupported treatments included: acupuncture, which has never been shown to work for depression despite a few scattered positive findings; laughter therapy, which is based on the untested notion that laughing can cure depression; and energy therapy, which is based on the untested notion that all people possess invisible energy fields that influence their moods. Although some of these treatments may be shown to be helpful in future studies (and all new approaches must begin as untested ideas), consumers who seek them out should be aware that there are empirically supported alternatives.
2. *Direct harm*. Pseudoscientific treatments occasionally do dreadful harm to those who receive them. Take the tragic case of Candace Newmaker, a 10-year-old girl who in 2000 underwent pseudoscientific treatment for behavioural problems (Mercer, Sarner & Rosa, 2003). Candace received a treatment called *rebirthing therapy*, which is premised on the scientifically doubtful notion that children's behavioural problems are attributable to difficulties in forming attachments to their parents stemming from birth—in some cases, even before birth. During rebirthing, children or adolescents re-enact the trauma of birth with the 'assistance' of one or more therapists (Mercer, 2002). During Candace's rebirthing session, two therapists wrapped her in a flannel blanket, sat on her and squeezed her repeatedly in an effort to simulate birth contractions. During the 40-minute session, Candace vomited several times and begged the therapists for air, complaining desperately that she could not breathe and felt as though she were going to die. When Candace was unwrapped from her symbolic 'birth canal', she was dead (Mercer, Sarner & Rosa, 2003).
3. *An inability to think critically as citizens*. Scientific thinking skills are not just important for evaluating psychological claims; we can apply them to all aspects of our lives. In our increasingly complex scientific and technological society, we need scientific thinking skills to reach educated decisions about climate change, genetically modified foods, stem-cell research, vaccine safety, novel medical treatments, and parenting and teaching practices, among dozens of other claims (Mooney & Kirshenbaum, 2010).

The take-home message is clear: pseudoscience matters. That is what makes scientific thinking so critical: although far from foolproof, it is our best safeguard against errors to which we are all prone.

Stem-cell research is controversial on both scientific and ethical grounds. To evaluate this and other controversies properly, we need to be able to think critically about the potential costs and benefits of such research.
Australian Associated Press Pty Ltd

1.3 Scientific thinking: distinguishing fact from fiction

Given that the world of popular psychology is chock-full of remarkable claims, how can we distinguish psychological fact—that is, the body of psychological findings that are so dependable we can safely regard them as true—from psychological fiction?

1.3a Identify the key features of scientific scepticism.

1.3b Identify and explain the text's six principles of scientific thinking.

Scientific scepticism

The approach we will emphasise throughout this text is **scientific scepticism**. To many people, the term 'scepticism' implies closed-mindedness, but nothing could be further from the truth. The term *scepticism* actually derives from the Greek word *skeptikos*, which means 'to consider carefully' (Shermer, 2002). The scientific sceptic evaluates all claims with an open mind, but insists on persuasive evidence before accepting them.

scientific scepticism
approach of evaluating all claims with an open mind, but insisting on persuasive evidence before accepting them

As astronomer Carl Sagan (1995) noted, to be a scientific sceptic we must adopt two attitudes that may seem contradictory but are not: first, a willingness to keep an open mind to all claims; and second, a willingness to accept these claims only after researchers have subjected them to careful scientific tests. Scientific sceptics are willing to change their minds when confronted with evidence that challenges their preconceptions. At the same time, they change their minds only when this evidence is persuasive. The motto of the scientific sceptic is 'show me'. Scientific sceptics require proponents of claims to provide evidence for these claims and they are willing to revise their beliefs if this evidence is sufficiently convincing. A closed-minded scientist is not a good scientist.

Closed-mindedness is marked by a tendency to dismiss any claims that contradict our beliefs. The closed-minded sceptic (or 'scoffer') is just as problematic as the gullible individual who accepts all claims at face value. Both uncritically accept the beliefs that please them.

Another key feature of scientific scepticism is an unwillingness to accept claims on the basis of authority alone. Scientific sceptics evaluate claims on their own merits and refuse to accept them until they meet a high standard of evidence. Of course, in everyday life we are often forced to accept the word of authorities simply because we do not possess the expertise, time or resources to evaluate every claim on our own. Most of us are willing to accept the claim that our local governments keep our drinking water safe without conducting our own chemical tests. While reading this chapter, you are also placing trust in us—the authors, that is—to provide you with accurate information about psychology. Still, this does not mean you should blindly accept everything we have written here. Consider what you are reading with an open mind, but evaluate it critically. If you disagree strongly with something we have written, be sure to investigate further.

A basic framework for scientific thinking

critical thinking
set of skills for evaluating all claims in an open-minded and careful fashion

The hallmark of scientific scepticism is **critical thinking**. Many students misunderstand the word '*critical*' in *critical thinking,* assuming incorrectly that it entails a tendency to attack all claims. In fact, critical thinking is a set of skills for evaluating all claims in an open-minded and careful fashion. We can also think of critical thinking in psychology as *scientific thinking*, as it is the form of thinking that allows us to evaluate scientific claims not only in the laboratory, but also in everyday life (Lilienfeld, Ammirati & David, 2012; Willingham, 2007).

Just as important, scientific thinking is a set of skills for overcoming our own biases, especially confirmation bias, which, as we have learned, can blind us to evidence we would prefer to ignore (Alcock, 1995; Begley & Ioannidis, 2015). In particular, in this text, we will be emphasising six principles of scientific thinking (Bartz, 2002; Lett, 1990) (see Figure 1.6). We should bear this framework of principles in mind when evaluating all psychological claims, including claims in the media, in self-help books, on the internet, in your introductory psychology course and, yes, most definitely in this textbook.

SCIENTIFIC THINKING PRINCIPLE #1: EXTRAORDINARY CLAIMS REQUIRE EXTRAORDINARY EVIDENCE. Throughout the book, we will abbreviate this principle as 'extraordinary claims'. This principle was proposed in slightly different terms by eighteenth-century Scottish philosopher David Hume (Sagan, 1995; Truzzi, 1978). According to Hume, the more a claim contradicts what we already know, the more persuasive (that is, objectively validated) the evidence for this claim must be before we should accept it.

For example, a handful of researchers believe that every night hundreds or even thousands of people are being lifted from their beds, taken aboard flying saucers and experimented on by aliens, only to be returned safely to their beds hours later (Clancy, 2005; McNally, 2012). As Carl Sagan (1995) commented, it is a wonder the neighbours have not noticed.

Of course, alien-abduction proponents *might* be right and we should not dismiss their claims out of hand. But their claims are pretty extraordinary, especially because they imply that tens of thousands of invading flying saucers from other solar systems have inexplicably managed to escape detection by astronomers, not to mention air traffic controllers and radar operators. Scientific sceptics—who point out that hypnosis can sometimes create vivid memories of bizarre events that never occurred (Blackmore, 1998; Lynn, Lock, Myers & Payne, 1997; see Chapters 5 and 7)—have challenged alien-abduction proponents to provide even a shred of concrete evidence that supposed abductees have actually encountered

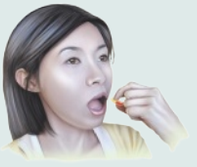
Name of principle	Explanation	Example	
EXTRAORDINARY CLAIMS IS THE EVIDENCE AS STRONG AS THE CLAIM?	The more a claim contradicts what we already know, the more persuasive the evidence for this claim must be before we should accept it.	The claim that a monster, like Bigfoot, has been living in the American Northwest for decades without being discovered by researchers requires more rigorous evidence than the claim that people remember more words from the beginning than from the end of a list.	
TESTING PREDICTIONS CAN THE CLAIM BE TESTED?	Scientists try to test the novel predictions of their (and rival) theories in order to find out if the theory really describes the world.	If your friend predicted the Broncos and the Storm will both win tomorrow but the Roosters and the Knights will lose and this prediction came true, you might think it could be due to chance. But if he instead predicted the Broncos will win by seven points and the Storm by one but the Roosters and the Knights will both lose by nine points and this came true, you might consider placing bets.	
OCCAM'S RAZOR DOES A SIMPLER EXPLANATION FIT THE DATA JUST AS WELL?	If two hypotheses explain a phenomenon equally well, we should generally select the simpler one.	If a person with poor vision claims to spot a flying saucer during a Frisbee tournament taking place on a foggy day, it is more likely that his UFO report is due to a simpler explanation—his mistaking a Frisbee for a UFO—than to alien visitation.	
REPLICABILITY CAN THE RESULTS BE DUPLICATED IN OTHER STUDIES?	A finding must be capable of being duplicated by independent researchers following the same 'recipe'.	If a researcher finds that people who practise meditation score 50 points higher on an intelligence test than people who do not but no one else can duplicate this finding, we should be sceptical of it.	
RULING OUT RIVAL HYPOTHESES HAVE IMPORTANT ALTERNATIVE EXPLANATIONS FOR THE FINDINGS BEEN EXCLUDED?	Findings consistent with several hypotheses require additional research to eliminate these hypotheses.	If an investigator finds that depressed people who receive a new medication improve more than do equally depressed people who receive nothing, this difference may be due to the fact that the people who received the medication expected to improve.	
CORRELATION VS CAUSATION CAN WE BE SURE THAT *A* CAUSES *B*?	The fact that two things are associated with each other does not mean that one causes the other.	The finding that people eat more ice-cream on days when many crimes are committed does not mean that eating ice-cream causes crime; both could be due to a third variable, such as higher temperatures.	

Figure 1.6 The six principles of scientific thinking used throughout this text.

extraterrestrials—say, a convincing photograph of an alien, a tiny piece of a metal probe inserted by an alien or even a strand of hair or shred of skin from an authentic alien. Thus far, all that alien-abduction proponents have to show for their claims are the self-reports of supposed abductees (which are likely sincere), but which have mostly been elicited by hypnotic suggestion. Extraordinary claims, but without objectively verified (extraordinary) evidence.

The bottom line: whenever you evaluate a psychological claim, ask yourself whether this claim runs counter to many things already known and, if it does, whether the evidence is strong enough to warrant the claim.

SCIENTIFIC THINKING PRINCIPLE #2: TESTING PREDICTIONS. Scientific theories try to explain what we observe in the world around us. That is, they have implications for how the world actually is. Scientists try to test the new predictions of their own (and rival) theories in order to find out whether the theory really describes the world. For a prediction to be testable, its proponent must state clearly in advance, not after the fact, which findings would count as evidence for and against the claim (Dienes, 2008; Proctor & Capaldi, 2006).

According to a few researchers, tens of thousands of people have been abducted by aliens and brought aboard spaceships to be experimented on. Could it really be happening, and how would we know?

Mary Evans Picture Library/The Image Works

According to philosopher of science Imre Lakatos (1974), to gain acceptance scientific theories must take the risk of making novel predictions. By a 'novel prediction', Lakatos meant a forecast that no one would expect were it not for that particular theory. The better a theory emerges from testing such risky novel predictions (theories do not usually emerge completely unscathed), the more other scientists will accept it. Like most of us, scientists do not usually give up because of a single failure. Instead, they try to modify their theories to explain what went wrong and then make new novel predictions from the modified theory to test in further experiments (Chalmers, 2013). If scientists succeed, the theory grows. However, if adherents simply keep adding modification upon modification to reconcile the theory with continuing failures, the theory becomes more and more insulated from reality and the scientific community moves on to consider more fruitful alternatives.

To be informative, a scientific theory must predict only certain outcomes, but not others. If a friend told you she had a master theory for AFL forecasting and predicted with great confidence, 'Tomorrow, all of the AFL teams that are playing a game will either win or lose', you would probably start laughing. By predicting every potential outcome, your friend has not really predicted anything.

Theories that do not (or will not) risk novel predictions are not interesting in science because they do not tell us anything new about the world. If your AFL-forecasting friend predicted, 'The Lions and the Blues will both win tomorrow, but the Crows and the Magpies will lose', and this prediction came true, you might think, 'Well, that's sort of interesting, but it still could be due to chance'. But if she instead predicted, 'Tomorrow, the Lions will win by seven points and the Blues will win by only one point, but the Crows and the Magpies will both lose by nine points', and this prediction came true, you might start to consider placing some bets.

The bottom line: whenever you evaluate a psychological claim, you should ask yourself how in principle you could test it. What novel predictions does it make that differentiate it from other theories?

SCIENTIFIC THINKING PRINCIPLE #3: OCCAM'S RAZOR. Occam's razor, named after fourteenth-century philosopher and Franciscan monk William of Occam, is also called the 'principle of parsimony' (*parsimony* is a synonym for 'logical simplicity'). According to Occam's razor, if two explanations account equally well for a phenomenon, we should generally select the more parsimonious one (Sober, 2015). Good researchers use Occam's razor to 'shave off' needlessly complicated explanations to arrive at the simplest explanation that does a good job of accounting for the evidence. Scientists of a romantic persuasion refer to Occam's razor as the principle of KISS: keep it simple, stupid.

There are two explanations for crop circles, one supernatural and the other natural. Which one should we believe?

Marcel Jancovic/Shutterstock

Occam's razor is only a guideline, not a hard-and-fast rule (Uttal, 2003). Every once in a while the best explanation for a phenomenon is not the simplest. But Occam's razor is a helpful rule of thumb, as it is right far more often than it is wrong.

Consider this example. During the late 1970s and 1980s, hundreds of mysterious designs, called crop circles, began appearing in wheat fields in England. Most of these designs were remarkably intricate, even beautiful. How on earth could these designs be explained? Many believers in alien visitors concluded that these designs originated not from earth, but from beings on distant worlds. The crop circles, they concluded, are proof positive of alien visitations to our world.

The crop circle hysteria came crashing down in 1991, when two British men, David Bower and Doug Chorley, confessed to creating the crop circles as a prank intended to poke fun at uncritical believers in extraterrestrials. They even demonstrated on camera how they used wooden planks and rope to stomp through tall fields of wheat and craft the complex designs. Many of these designs, incidentally, had been signed with two Ds (for 'David' and 'Doug'), which true believers in crop circles had interpreted as an encoded message from aliens.

Occam's razor reminds us that when confronted with two explanations that fit the evidence equally well, we should generally select the simpler one, in this case human pranksters. As former US Secretary of State Colin Powell argued at the United Nations Security Council, however, the simplest explanation for the mass of intelligence data before the 2003 Iraq War was that Saddam Hussein possessed weapons of mass destruction. As Albert Einstein famously remarked: 'Everything should be made as simple as possible, but not simpler'.

The bottom line: whenever you evaluate a psychological claim, ask yourself whether the explanation offered is the simplest explanation that accounts for the data or whether simpler explanations can account for the data equally well.

SCIENTIFIC THINKING PRINCIPLE #4: REPLICABILITY. Barely a week goes by that you do not hear about another stunning psychological finding on the evening news: 'Researchers at Cupcake University detect a new gene linked to excessive late night internet shopping'; 'Investigators at the University of Antarctica at Igloo report that alcoholism is associated with a heightened risk of murdering one's spouse'; 'Nobel-Prize-winning professor at Flying Pigs Institute of Technology isolates brain area responsible for the enjoyment of bacon'. One problem with these conclusions, in addition to the fact that the news media often tell us nothing about the design of the studies on which they are based, is that the findings usually have not been replicated. **Replicability** means that a study's findings can be duplicated consistently. Replication is the cornerstone of a dependable science.

replicability
demand that a study's findings be duplicated, ideally by independent investigators

Indeed, over the past decade, psychological scientists have become increasingly aware of the importance of replication (Asendorpf et al., 2013; Lilienfeld & Waldman, 2016; Nosek, Spies & Motyl, 2012). Some of this heightened awareness stems from difficulties in replicating certain findings in psychology that had been previously assumed to be well established (Lindsay, 2015; Pashler & Wagenmakers, 2012). Some of it also stems from the **decline effect** (Schooler, 2011). For example, early studies of the effectiveness of newly developed medications for schizophrenia showed larger effects than more recent studies (Leucht et al., 2009). The same decline in effectiveness over time may hold for parenting interventions for autism spectrum disorder (Ozonoff, 2011) and the effectiveness of cognitive-behavioural therapy for depression (Johnsen & Friborg, 2015). Although psychologists are not sure how widespread a problem the decline effect is, virtually all agree that it sometimes exists.

decline effect
fact that the size of certain psychological findings appears to be shrinking over time

In 2012, social psychologist Brian Nosek and his collaborators launched the Open Science Collaboration, a coordinated effort by a team of dozens of psychologists around the globe to try to replicate widely cited studies in psychology (Carpenter, 2012). In 2015, they published a 'bombshell' article that attempted to replicate 100 published findings in social and cognitive psychology; to the surprise of many, they found that only about 40 per cent of the original findings could be replicated (Open Science Collaboration, 2015). This sobering result does not necessarily mean that the original positive findings were wrong; it is instead possible that the later findings were wrong or that the original findings hold up only in certain settings or among certain groups of individuals (Gilbert, King, Pettigrew & Wilson, 2016). In any case, the results of the Open Science Collaboration show that the replicability of psychological results cannot be taken for granted.

Psychologist Brian Nosek at the newly launched Center for Open Science. Nosek has been a pioneer in the effort to determine the extent to which psychological findings are replicable.
Bill O'Leary/The Washington Post/Getty Images

Most replications are not exact duplications of the original researchers' methods. Most involve introducing minor variations in the original design or extending this design to different participants, including those in various cultures, races and geographical locations. In general, the more findings can be replicated using different participants in different settings, the more confidence we can place in those findings (Schmidt, 2009; Shadish, Cook & Campbell, 2002).

Bear in mind also that the media are far more likely to report initial positive findings than failures to replicate. The initial findings may be especially fascinating or sensational, whereas replication failures are often disappointing—they just do not make for juicy news stories! It is especially crucial that investigators other than the original researchers replicate the results because this increases confidence in them. If somebody tells you that they have

Scientific thinking involves ruling out rival hypotheses. In this case, how do we know this woman's weight loss resulted from a specific diet plan? During this time, she might have exercised or used another diet plan. Or perhaps the pants she is holding up were never hers to begin with.

Stephen Coburn/Shutterstock.com

created a recipe for the world's most delicious garlic prawn pizza, but it turns out that every other chef who follows this recipe ends up with a meal that tastes like mouldy cardboard covered in something John West would flat out reject, you would be justifiably sceptical. Maybe the person lied about the recipe. Or perhaps they were not following the recipe closely and were instead tossing in ingredients that were not even in the recipe. Or perhaps they are such an extraordinary chef that nobody else can come close to replicating their miraculous culinary feats. In any case, you would have every right to doubt the recipe until someone else replicated it. The same principle goes for psychological research.

The literature on ESP offers an excellent example of why replicability is so essential. Many successful ESP experiments have been reported (so have many unsuccessful experiments), but successful replications are far fewer (Cardeña, Palmer & Marcusson-Clavertz, 2015; Irwin & Watt, 2007; Ritchie, Wiseman & French, 2012). So far, no one has come up with an ESP experiment with positive results that can be readily replicated by other researchers (or even the same researcher). This lack of replicability does not necessarily mean that ESP is not real. Still, the absence of a readily reproducible 'experimental recipe' for ESP has left most psychological scientists doubtful of its existence.

Not all replications are created equal. Just because a finding has been replicated does not necessarily mean it is believable; this is because we still need to make sure that the studies are well conducted. If an investigator performs a flawed study, and a second investigator replicates her findings while repeating the same mistakes, we should disregard this replication. Similarly, not all replication failures are created equal. A second investigator could fail to replicate a previous investigator's findings because she did not conduct the study properly. So before deciding how much weight to place on either a replication or a replication failure, we must first evaluate the study's quality.

The bottom line: whenever you evaluate a psychological claim, ask yourself whether independent investigators have replicated the findings that support this claim; otherwise, the findings might be a one-time-only fluke.

SCIENTIFIC THINKING PRINCIPLE #5: RULING OUT RIVAL HYPOTHESES. Most psychological findings you hear about on television or read about online lend themselves to multiple explanations. Yet the media often report only one explanation and we should not automatically assume it is correct. Instead, we should ask ourselves a key question: is this the *only* good explanation for this finding? Have we ruled out other important competing explanations (Huck & Sandler, 1979; Platt, 1964)?

Let us take an increasingly popular treatment for anxiety disorders, Thought Field Therapy (TFT; Feinstein, 2012), an 'energy therapy' now practised by thousands of mental health professionals. TFT is premised on the notion that our bodies are surrounded by invisible energy fields and that anxiety disorders, as well as some other psychological conditions, result from blockages in these fields. TFT therapists attempt to remove energy blockages by tapping on various body areas in a specific order, often while asking clients to hum song tunes. Here is the problem: well-controlled studies show that TFT works better than nothing, but there is not a shred of good evidence that it works better than standard treatments for anxiety disorders (Pignotti & Thyer, 2009). Most TFT advocates have neglected to consider a rival explanation for TFT's success: like many other effective treatments for anxiety disorders, TFT asks patients to repeatedly expose themselves to anxiety-provoking imagery. Researchers and therapists alike have long known that prolonged exposure itself can be therapeutic (Craske, Treanor, Conway, Zbozinek & Vervliet, 2014). By not excluding the rival hypothesis that TFT's effectiveness stems from exposure rather than from tapping on specific body parts, TFT advocates have advanced claims that run well ahead of the data.

The bottom line: whenever you evaluate a psychological claim, ask yourself whether you have excluded other plausible explanations for it.

SCIENTIFIC THINKING PRINCIPLE #6: CORRELATION IS NOT NECESSARILY CAUSATION. Perhaps the most common mistake beginning psychology students make when interpreting studies is to conclude that when two things are associated with each other—or what psychologists call 'correlated' with each other—one thing must cause the other. This point leads us to one of the most crucial principles in this text: *correlational designs by themselves do not permit causal inferences* or, putting it less formally, *correlation is not always*

Remarkable dietary claims

evaluating CLAIMS

Imagine you are a busy, overworked university student who likes to drink coffee to wake up in the morning and stay alert in the afternoon. You especially love those delicious, but fattening, specialty coffee drinks. As much as you enjoy coffee and want to drink it to decrease your fatigue, you also do not want to put on weight.

A new coffee shop, Moonbeams, has just opened up a few blocks from campus. Moonbeams is advertising a yummy 'supersize' caramel frappuccino; they call it the 'Weight Buster' with the claim that 'Incredible as it sounds, you can actually lose weight by drinking our Weight Buster!'. When you ask the store manager how that is possible, she says 'Our company recently conducted a rigorous study of six people who drank at least one Weight Buster every day for two weeks. All of them lost weight, ranging from two to nine kilos. Science does not lie!'.

Paylessimages/123RF

Scientific scepticism requires us to evaluate all claims with an open mind but to insist on compelling evidence before accepting them. How do the principles of scientific thinking help us to evaluate Moonbeams' claim that you can lose weight by drinking the Weight Buster? Consider how the six principles of scientific thinking are relevant as you evaluate this claim.

1 EXTRAORDINARY CLAIMS

Is the evidence as strong as the claim?

The assertion that a large, creamy and sugary drink causes weight loss is pretty darn extraordinary. Yet the evidence for it is based on only one tiny study that did not even include a control group. The evidence is far weaker than the claim.

2 TESTING PREDICTIONS

Can the claim be tested?

The claim that the Weight Buster helps people to lose weight could in principle be tested, but it would require an experimental design with random assignment to conditions. Note that Moonbeams did not conduct that study, or if they did, they are not telling you what they found.

3 OCCAM'S RAZOR

Does a simpler explanation fit the data just as well?

In this case, there are more plausible explanations for the store manager's conclusions, such as that the six people studied are not typical of all participants or that the company is reporting only the results that support their hypothesis.

4 REPLICABILITY

Can the results be duplicated in other studies?

According to the store manager, the evidence that the Weight Buster leads to weight loss was based on only a single study. We should be sceptical of findings based on only one study, especially when these results are extremely surprising.

5 RULING OUT RIVAL HYPOTHESES

Have important alternative explanations for the findings been excluded?

The results of the study are open to many alternative interpretations, so they do not necessarily demonstrate that drinking the Weight Buster leads to weight loss. For example, perhaps people who drank the kilojoule-laden drink also consumed less food because they knew that the drink was fattening. Or maybe the six people who drank the coffee knew they were being studied, so they worked especially hard to lose weight.

6 CORRELATION VS CAUSATION

Can we be sure that *A* causes *B*?

This critical thinking principle is not especially relevant to this scenario (because the study does not describe a correlation).

Summary

The evidence reported by the store manager derives from a small, unreplicated study that is seriously flawed because it does not contain a control group.

causation. When we mistakenly conclude that a correlation must mean causation, we have committed the **correlation–causation fallacy**. This conclusion is a fallacy because the fact that two variables are correlated does not necessarily mean that one causes the other. Incidentally, a **variable** is anything that can vary, such as height, IQ or extraversion.

So why is correlation not causation? If we start with two variables, *A* and *B*, that are correlated, there are three major explanations for this correlation.

1. $A \rightarrow B$. First, it is possible that variable *A* causes variable *B*.
2. $B \rightarrow A$. Second, it is possible that variable *B* causes variable *A*. Here the 'causal arrow' (the arrow is reversed between *A* and *B*) connects the variables in the opposite order, with *B* coming before *A*.

correlation–causation fallacy
error of assuming that because one thing is associated with another, it must cause the other

variable
anything that can vary

So far, so good. But many people forget about a third possibility, namely:

3 $C \nearrow A$, $C \searrow B$

In this third scenario, there is a third variable, *C*, which causes both *A* and *B*. This scenario is known as the **third variable problem**. It is a 'problem' because it can lead us to conclude mistakenly that *A* and *B* are causally related to each other when they are not.

third variable problem
case in which a third variable causes the correlation between two other variables

In this third scenario, a third variable, C, causes both A and B. This scenario is known as the *third variable problem*. It is a problem because it can lead us to conclude mistakenly that A and B are causally related to each other when they are not. For example, in one recent study, researchers found that teenagers who listened to music with a lot of sexual lyrics had sexual intercourse considerably more often than teenagers who listened to music with far tamer lyrics (Martino et al., 2006). That is, they found that listening to sexual lyrics is *correlated* with sexual behaviour. One newspaper summarised the findings with an attention-grabbing headline: 'Sexual lyrics prompt teens to have sex' (Tanner, 2006). But like many headlines, this one went well beyond the data. It is indeed possible that music with sexual lyrics (*A*) causes sexual behaviour (*B*). But it is also possible that sexual behaviour (*B*) causes teens to listen to music with sexual lyrics (*A*), or that a third variable, such as impulsivity (*C*), causes teens to both listen to music with sexual lyrics and engage in sexual behaviour. Given the data reported by the authors, there is no way to know.

The bottom line: we should remember that a correlation between two things does not necessarily demonstrate that there is a causal connection between them.

Correlation is not necessarily causation.
Family Circus © Bil Keane, Inc. King Features Syndicate

Stop and think

How do the principles of scientific thinking help prevent us from falling prey to errors and biases in thinking?

1.4 Psychology's past and present: what a long, strange trip

1.4a Identify the major theoretical frameworks of psychology.

1.4b Describe different types of psychologists and identify what each of them does.

1.4c Describe the two great debates that have shaped the field of psychology.

1.4d Describe how psychological research affects our daily lives.

1.4e Explain how evidence-based practice can help bridge the scientist–practitioner gap.

How did psychology emerge as a scientific discipline? The scientific approach to the study of the mind, brain and behaviour emerged slowly, and the field's initial attempts displayed many of the weaknesses that pseudoscientific approaches possess today. Informal attempts to study and explain how our minds work have been with us for thousands of years. But psychology as a science has existed for only about 140 years, and many of those years were spent refining techniques to develop methods to safeguard research against inevitable human bias (Coon, 1992). Throughout its history, psychology has struggled with many of the same challenges that we confront today when reasoning about psychological research. So it is important to understand how psychology evolved as a scientific discipline—that is, a discipline that relies on systematic research methods to avoid being fooled.

Psychology's early history

We start our journey with a capsule summary of psychology's bumpy road from non-science to science. (A timeline of significant events in the evolution of scientific psychology can be seen in Figure 1.7).

For many centuries, the questions of psychology were pursued as a field of inquiry within philosophy. Most academic psychologists held positions in departments of philosophy or sometimes physiology. (Psychology departments did not exist until Wilhelm Wundt's time—see below.) However, systematic experimental research on psychological matters was being conducted by many individuals even in the eighteenth century. Yet even by 1808, Carus had published his *History of Psychology*, a review of more than 120 quantitative studies from the previous century. In the 1850s, Fechner developed experimental methods to investigate the mathematical relationship between perceptual sensations and physical stimulation (Fechner, 1860). In 1879, Wilhelm Wundt (1832–1920) developed the first fully fledged psychological

Late 1700s: Frans Anton Mesmer discovers principles of hypnosis

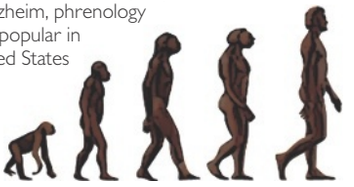
1600

1649: René Descartes writes about the mind–body problem

1700

1800

Early 1800s: Due to efforts of Franz Joseph Gall and Joseph Spurzheim, phrenology becomes immensely popular in Europe and the United States



1850: Gustav Fechner experiences crucial insight linking physical changes in the external world to subjective changes in perception; leads to establishment of psychophysics

1850

1859: Charles Darwin writes *On the Origin of Species*

1875: William James creates small psychological laboratory at Harvard University

1879: Wilhelm Wundt creates world's first formal psychological laboratory

1881: Wundt establishes first psychology journal

1889: Sir Francis Galton introduces concept of correlation, allowing psychologists to quantify associations among variables

1890: William James writes *Principles of Psychology*

1905: Alfred Binet and Henri Simon develop first intelligence test

1900

1900: Sigmund Freud writes *The Interpretation of Dreams,* landmark book in the history of psychoanalysis

1910: Ivan Pavlov discovers classical conditioning

1907: Oscar Pfungst demonstrates that the amazing counting horse, Clever Hans, responds to cues from observers; demonstrates power of expectancies

1911: E. L. Thorndike discovers instrumental (later called operant) conditioning

1913: John B. Watson writes *Psychology as Behavior,* launching field of behaviourism

1920s: Gordon Allport helps to initiate field of personality trait psychology

1920: Jean Piaget writes *The Child's Conception of the World*

1924: Hans Berger discovers and records the human EEG

1935: Kurt Koffka writes *Principles of Gestalt Psychology*

1938: B. F. Skinner writes *The Behavior of Organisms*

1949: Conference held at University of Colorado at Boulder to outline principles of scientific clinical psychology; founding of the 'Boulder' (scientist–practitioner) model of clinical training

1950

1952: Antipsychotic drug Thorazine tested in France, launching modern era of psychopharmacology

1953: Francis Crick and James Watson discover structure of DNA, launching genetic revolution

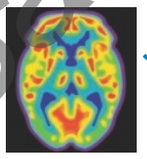
1954: Paul Meehl writes *Clinical versus Statistical Prediction,* first major book to describe both the strengths and weaknesses of clinical judgement

1953: Rapid eye movement (REM) sleep discovered

1963: Stanley Milgram publishes classic laboratory studies of obedience

1958: Joseph Wolpe writes *Psychotherapy by Reciprocal Inhibition,* helping to launch field of behavioural therapy

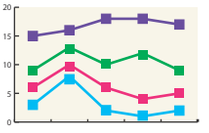
1974: Positron emission tomography (PET) scanning introduced, launching field of functional brain imaging



1967: Ulric Neisser writes *Cognitive Psychology;* helps to launch field of cognitive psychology

1974: Elizabeth Loftus and Robert Palmer publish classic paper on the malleability of human memory, showing that memory is more reconstructive than previously believed

1977: First use of statistical technique of meta-analysis, which allows researchers to systematically combine results of multiple studies; demonstrated that psychotherapy is effective



1980: *Diagnostic and Statistical Manual of Mental Disorders, Third Edition (DSM-III)* published; helps standardise the diagnosis of major mental disorders

1980s: Recovered memory craze pits academic researchers against many clinicians

1990: Thomas Bouchard and colleagues publish major results of Minnesota Study of Twins Reared Apart, demonstrating substantial genetic bases for intelligence, personality, interests and other important individual differences

1992: Ogawa and Kwong publish the first fMRI images using the BOLD signal

2000

2000: Human genome sequenced

1995: Task force of Division 12 (Society of Clinical Psychology) of American Psychological Association publishes list of, and criteria for, empirically supported psychotherapies

2002: Daniel Kahneman becomes first PhD psychologist to win Nobel Prize; honoured for his pioneering work (with the late Amos Tversky) on biases and heuristics

2012: Human Brain Project established (Lausanne, Switzerland) to simulate the complete human brain on a network of supercomputers

Figure 1.7 **A timeline of major events in scientific psychology.**

Wilhelm Wundt (*right*) in the world's first psychology laboratory. Wundt is generally credited with launching psychology as a laboratory science in 1879.

The Drs Nicholas and Dorothy Cummings Center for the History of Psychology, The University of Akron

laboratory in Leipzig, Germany, four years after William James had founded a less formal laboratory at Harvard University.

Most of Wundt's investigations and those of his students focused on basic questions concerning our mental experiences: How different must two colours be for us to tell them apart? How long does it take us to react to a sound? What thoughts come to mind when we solve a maths problem? Wundt used a combination of experimental methods, including reaction time equipment, and a technique called **introspection**, which required trained observers to carefully attend to and report upon their mental experiences. The pioneering work of researchers such as Fechner and Wundt marked the beginnings of psychology as a science because they demonstrated that mental events *could* be quantified and then studied mathematically, just as Galileo (1564–1642) had studied the motion of falling bodies. Soon, psychologists elsewhere around the world followed Wundt's bold lead and opened laboratories in departments of psychology.

introspection
method by which trained observers carefully attend to and report upon their mental experiences

Before becoming a science, psychology also needed to break free from another influence: spiritualism. The term *psychology* literally means the study of the *psyche*—that is, the spirit or soul. In the mid- and late 1800s, Europeans and Americans became fascinated with *spirit mediums*, people who claimed to contact the dead, often during séances (Blum, 2006). Séances were group sessions that took place in darkened rooms in which mediums attempted to 'channel' the spirits of deceased individuals. Many famous psychologists of the day, including William James, invested a great deal of time and effort investigating self-professed spirit mediums and psychics (Benjamin & Baker, 2004; Blum, 2006).

Despite their concerted efforts, James and his fellow psychic inquirers never obtained compelling evidence for the existence of discarnate spirits (Blum, 2006) and psychology eventually distanced itself from spiritualism. In doing so it forged a new field: the psychology of human error and self-deception. Rather than focusing on the extrasensory powers of mediums, a growing number of psychologists in the late 1800s began to ask the equally fascinating question of how people can fool themselves into believing things that are not supported by evidence (Coon, 1992)—a central theme of this book.

The great theoretical frameworks of psychology

Almost since its inception, psychological science has confronted a thorny question: what unifying theoretical perspective best explains behaviour?

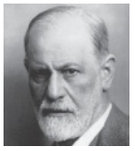
Five major theoretical perspectives—structuralism, functionalism, behaviourism, cognitivism and psychoanalysis—have played pivotal roles in shaping contemporary psychological thought. Many beginning psychology students understandably ask: 'Which of these perspectives is the right one?'. As it turns out, each theoretical viewpoint has something valuable to contribute to scientific psychology, but each has its limitations (see Table 1.5). In some cases, these different viewpoints are not contradictory because they are explaining behaviour at different levels of analysis. As we explore these five frameworks, you will discover that psychology's view of what constitutes a scientific approach to behaviour has changed over time and continues to evolve today.

STRUCTURALISM: THE ELEMENTS OF THE MIND. Edward Bradford Titchener (1867–1927), a British student of Wundt who emigrated to the United States to teach at Cornell University, founded the field of structuralism. **Structuralism** aimed to identify the basic elements, or 'structures', of psychological experience. Adopting Wundt's method of introspection, structuralists dreamed of creating a comprehensive 'map' of the elements of consciousness—which they believed consisted of sensations, images and feelings—much like the periodic table of elements found in every chemistry classroom (Evans, 1972).

structuralism
school of psychology that aimed to identify the basic structures of psychological experience

Nevertheless, structuralism eventually ran out of steam. At least two major problems led to its demise. First, even highly trained introspectionists often disagreed on their subjective reports. Because science depends on the ability to duplicate findings across different laboratories, this lack of consensus proved to be an embarrassment. Second, German psychologist Oswald Kulpe (1862–1915) showed that participants asked to solve certain mental problems engage in *imageless thought*: thinking unaccompanied by conscious experience. If we ask an introspecting participant to add 10 and five, she will quickly respond '15', but she will usually be unable to report what came to her mind when performing this calculation (Hergenhahn,

Table 1.5 The theoretical perspectives that shaped psychology

PERSPECTIVE		LEADING FIGURES	SCIENTIFIC GOAL	LASTING SCIENTIFIC INFLUENCE
	Structuralism	E. B. Titchener	Uses introspection to identify basic elements or 'structures' of experience	Emphasis on the importance of systematic observation to the study of conscious experience
	Functionalism	William James; influenced by Charles Darwin	To understand the functions or adaptive purposes of our thoughts, feelings and behaviours	Has been absorbed into psychology and continues to influence it indirectly in many ways
	Behaviourism	Ivan Pavlov; John B. Watson; B. F. Skinner	To uncover the general principles of learning that explain all behaviours; focus is largely on observable behaviour	Influential in models of human and animal learning, and among the first to focus on need for objective research
	Cognitivism	Jean Piaget; Ulric Neisser	To examine the role of mental processes on behaviour	Influential in many areas, such as language, problem solving, concept formation, intelligence, memory and psychotherapy
	Psychoanalysis	Sigmund Freud	To uncover the role of unconscious psychological processes and early life experiences in behaviour	Understanding that much of our mental processing goes on outside of conscious awareness

(*Sources:* Archives of the History of American Psychology—The University of Akron; Picture History/Newscom; Photo Researchers, Inc./Science Source/; Bettman/Corbis Australia Pty Ltd; Library of Congress.)

2000). The phenomenon of imageless thought dealt a serious blow to structuralism because it demonstrated that some important aspects of human mental processes lie outside of conscious awareness. This point was also to become central to Freud's subsequent development of psychoanalysis. Today, methods closely related to structuralism are making a decisive contribution in conjunction with modern neuroscience in the scientific search for the neural correlates of consciousness (Jamieson, 2007).

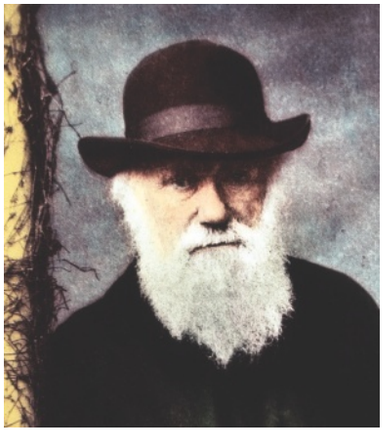
Structuralism underscored the importance of *systematic observation* to the study of conscious experience. Nevertheless, the early structuralists went astray by assuming that a single method, introspection—with its inherent strengths and weaknesses—could provide all of the information needed for a complete science of psychology. In the time since introspectionism came and went, psychologists have learned that multiple methods are almost always needed to understand complex psychological phenomena (Cook, 1985; Figueredo, 1993).

FUNCTIONALISM: PSYCHOLOGY MEETS DARWIN. Proponents of **functionalism** (inspired by the American philosophical school known as 'pragmatism') hoped to understand the adaptive purposes, or functions, of psychological characteristics, such as thoughts, feelings and behaviours (Hunt, 1993). Whereas structuralists asked 'what' questions (such as 'What is conscious thought like?'), functionalists asked 'why' questions (such as 'Why do we sometimes forget things?'). The founder of functionalism, William James, rejected structuralists' approach and methods, arguing that careful introspection yields not a fixed number of static structures comprising consciousness, but rather an ever-changing 'stream of consciousness', a famous phrase he coined. Consciousness, functionalists asserted, is more akin to a flowing river than the objects found in a dried-out riverbed.

functionalism
school of psychology that aimed to understand the adaptive purposes of psychological characteristics

The functionalists of the late 1800s were influenced substantially by biologist Charles Darwin's (1809–1882) still-young theory of **natural selection**, which emphasised that the

natural selection
principle that organisms that possess adaptations survive and reproduce at a higher rate than other organisms



Charles Darwin's theory of evolution by natural selection was a significant influence on functionalism, which strove to understand the adaptive purposes of psychological characteristics.

SPL/Science Source

heritable characteristics of organisms evolved because they were useful in the struggle to survive and reproduce. The functionalists believed that Darwin's theory applied to psychological characteristics, too. Just as the trunk of an elephant serves useful functions for survival, such as snaring distant water and food, the human memory system, for example, must similarly serve a purpose. It is the job of psychologists, functionalists maintained, to act as 'detectives', figuring out the evolved functions that psychological characteristics serve for organisms.

Like structuralism, functionalism does not exist in its original form today. Instead, functionalism was gradually absorbed into mainstream scientific psychology and continues to influence it indirectly in many ways. Indeed, many psychologists today are actively studying the potential evolutionary functions served by personality traits, such as empathy and aggression, and by emotions, such as jealousy and fear (Buss, 2015).

BEHAVIOURISM: THE LAWS OF LEARNING. In the early twentieth century, American psychologists in particular were growing impatient with the methods and questions of Titchener and other introspectionists. For these critics, the study of consciousness was a waste of time because researchers could never verify conclusively the existence of the basic elements of psychological experience. Psychological science, they contended, must be objective, not subjective.

behaviourism
school of psychology that focuses on uncovering the general laws of learning by looking outside the organism

Foremost among these critics was a flamboyant American psychologist, John B. Watson (1878–1958). Watson founded the still-influential school of **behaviourism**, which focuses on uncovering the general principles of learning underlying human and animal behaviour. For Watson (1913), the proper subject matter of psychology was nothing but the prediction and control of observable behaviour. Subjective reports of conscious experience should play no part in psychology. If psychology followed his brave lead, Watson proclaimed, it could become just as scientific as physics, chemistry and other 'hard' sciences. Watson's view of science was based on the positivist philosophy of Comte and Mach, who dismissed all unobservable entities (including, problematically, atoms and electrons) from the domain of meaningful scientific discourse (Leahey, 2004).

Watson, like his follower Burrhus Frederic (B. F.) Skinner (1904–1990), insisted that psychology should aspire to uncover the general laws of learning that explain all behaviours, whether they be riding a bicycle, eating a sandwich or becoming depressed. All of these behaviours, Watson proposed, were products of a handful of basic learning principles. Moreover, according to Watson, we do not need to peer 'inside' the organism to grasp these principles. We can comprehend human behaviour exclusively by looking *outside* the organism, to rewards and punishments delivered by the environment. For traditional behaviourists, the human mind (and the human brain) is a *black box*: we know what goes into it and what comes out of it, but we need not worry about what happens between the inputs and outputs. For this reason, psychologists sometimes call behaviourism 'black box psychology'.

Behaviourism has left a stamp on scientific psychology that continues to be felt today. By seeking to identify the fundamental laws of learning that help to explain human and animal behaviour, behaviourists placed psychology on firmer scientific footing. Behaviourist philosophy was never adopted by biologists studying animal behaviour (called 'ethologists'), who continued to emphasise the importance of internal (and thus unseen) biological drive states in mediating the response of organisms to their environment (Tinbergen, 1951). The early (and current) behaviourists however, properly warn us of the hazards of relying too heavily on reports that we cannot verify objectively.

COGNITIVISM: OPENING THE BLACK BOX. Beginning in the 1950s and 1960s, growing numbers of psychologists grew disillusioned with behaviourists' neglect of **cognition**, the term psychologists use to describe the mental processes involved in different aspects of thinking. Although behaviourists acknowledged that humans and even many intelligent animals do think, they viewed thinking as merely another form of behaviour. Proponents of cognitive psychology, in contrast, argued that our thinking affects our behaviour in powerful ways. For example, Swiss psychologist Jean Piaget (1896–1980) argued compellingly that children conceptualise the world in markedly different ways from adults. Later, led by Ulric Neisser (1928–2012) and George Miller (1920–2012), cognitivists argued that thinking is so central to psychology that it merits a separate discipline in its own right (Neisser, 1967).

cognition
mental processes involved in different aspects of thinking

According to cognitivists, predictions of behaviour based solely on rewards and punishments from the environment will never be adequate, because our *interpretation* of rewards and punishments is a crucial determinant of our behaviour. Take a student who receives a distinction on his first psychology exam. A student accustomed to getting credits on his tests might regard this grade as a reward, whereas a student accustomed to getting high distinctions might view it as a punishment. Without understanding how people evaluate information, cognitivists maintain, we will never fully grasp the causes of their behaviour. Moreover, according to cognitivists, we often learn not merely by rewards and punishments but by *insight*—that is, by grasping the underlying nature of problems.

Cognitive psychology remains enormously influential today and its influence has spread to such diverse domains as language, problem solving, concept formation, intelligence, memory and psychotherapy. By focusing not merely on rewards and punishments but also on organisms' interpretation of them, cognitivism has encouraged psychologists to peek inside the black box to examine the connections between inputs and outputs. Moreover, like the other major schools of psychological inquiry, cognitivism has increasingly established strong linkages to the study of brain functioning, allowing psychologists to better understand the physiological bases of thinking, memory and other key mental functions (Ilardi & Feldman, 2001). A burgeoning field, **cognitive neuroscience**, which examines the relation between brain functioning and thinking, has come to the fore over the past decade or so (Gazzaniga, Ivry & Mangun, 2002; Ward, 2015). Cognitive neuroscience and the allied field of affective neuroscience (Ochsner & Gross, 2008; Panksepp, 2004), which examines the relation between brain functioning and emotion, hold out the promise of allowing us to better understand the biological processes associated with thinking and feeling.

cognitive neuroscience
study of how mental processes are related to activity in the brain

PSYCHOANALYSIS: THE DEPTHS OF THE UNCONSCIOUS. Around the time that behaviourism was becoming dominant in the United States, a parallel movement was gathering momentum in Europe. This field, **psychoanalysis**, was founded by the Viennese neurologist Sigmund Freud (1856–1939). In sharp contrast to behaviourism, psychoanalysis focused on internal psychological processes in mediating the inevitable conflicts between biological drives pressing for expression and the demands to restrict and control them required for adaptation to society. According to Freud (1900) and other psychoanalysts, the function of the conscious self is to mediate the demands of inner and outer reality, and many psychological illnesses result from a disruption of this adaptive function. A key Freudian idea is that our conscious experiences can sometimes be motivated by ideas and feelings of which we are not aware.

psychoanalysis
school of psychotherapy, founded by Sigmund Freud, which focuses on internal drives and conflicts that shape the relationship between conscious and unconscious mental processes

The couch that Sigmund Freud used to psychoanalyse his patients is now located in the Freud museum in London. Contrary to popular stereotypes, most psychologists are not psychotherapists and most psychotherapists are not psychoanalysts. Nor do most modern therapists (including psychoanalysts) ask patients to recline on couches.
Peter Aprahamian/Corbis Australia

The goal of traditional psychoanalysis (many contemporary psychoanalysts have departed significantly from this model) is to help their clients to become more aware of these unconscious processes and thereby to gain greater control over them, enlarging their freedom to make fully conscious choices. Psychoanalysts also place considerably more emphasis than behavioural and cognitive psychotherapists do on the role of early experience in laying the foundation for later (adaptive and maladaptive) patterns of behaviour. For Freud and later attachment theorists, the core structure of the self is moulded in the early years of life.

The major influence of psychoanalysis on contemporary psychology has been in the area of psychotherapy, particularly in the field of personality disorders (Beck, Davis, Freeman & associates, 2015; Linehan, 1993), in the development of attachment theory and in the investigation of infant–caregiver relationships and the development of self-regulation (Fonagy, Gergely & Target, 2008).

Critics insist that psychoanalysis retarded the development of scientific approaches to psychotherapy because it focuses on unconscious processes that are difficult or impossible to directly test. These critics probably have a point (Crews, 2005; Esterson, 1993). The psychoanalytic claim that a great deal of mental processing goes on outside of conscious awareness has held up well in scientific research (Schwartz, 2015; Westen, 1998; Wilson, 2002). Freud's view of the

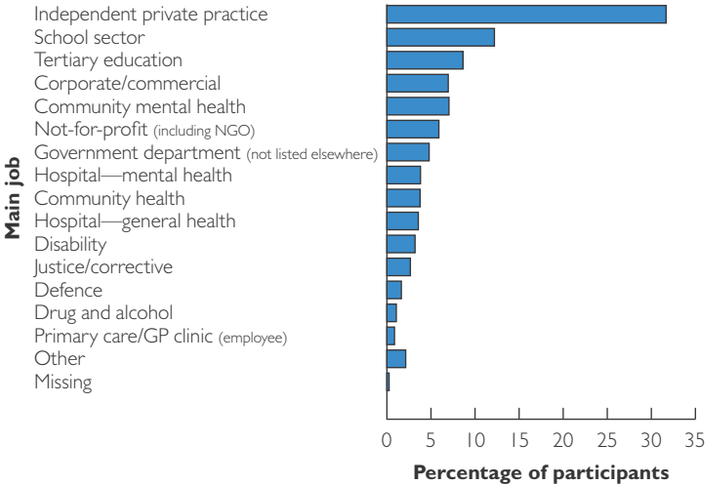


Figure 1.8 Approximate distribution of psychologists in different settings in Australia. Psychologists are employed in a diverse array of settings.

unconscious is rooted in the neurophysiology of his teacher Helmholtz, which is based on the thermodynamic concepts of the flow of energy, and is quite unlike contemporary cognitive views of unconscious processing (Kihlstrom, 1987; Turnbull & Solms, 2007), although this approach is currently undergoing a renaissance within cognitive neuroscience (Carhart-Harris & Friston, 2010).

The multifaceted world of modern psychology

Psychology is not just a single discipline, but rather a mixed bag of many subdisciplines. These subdisciplines differ widely in their preferred level of analysis, ranging all the way from biological to cultural. In most major psychology departments, you can find researchers examining areas as varied as the neurological bases of visual perception, the mechanisms of memory, the causes of prejudice and the treatment of depression.

TYPES OF PSYCHOLOGISTS: FACT AND FICTION. Figure 1.8 shows a breakdown of the settings in Australia in which psychologists work. As we can see, some work primarily in research settings; others, primarily in practice settings. Table 1.6 describes a few of the most important types of psychologists whose work we will encounter in this book. It also dispels common misconceptions about what each type of psychologist does, pairing each misconception with accurate information (Rosenthal, Soper, Rachal, McKnight & Price 2004).

To learn more about other fields of psychology, as well as other career options for psychology graduates, visit www.psychology.org.au/studentHQ/careers-in-psychology/. By now, we hope we have persuaded you that the field of psychology is remarkably diverse. Moreover, the face of psychology is changing, with more women and minorities entering many of its subfields. Despite their differences in content, all of these areas of psychology have one thing in common: most of the psychologists who specialise in them rely on scientific methods. Specifically, they use scientific methods to generate new findings about human or animal behaviour, or use existing findings to enhance human welfare.

Great debates of psychology

Now that you have learned a bit about the past and present of psychology, we need to set the stage for things to come. Two great debates have shaped the field of psychology since its inception and are likely to continue to shape it in the future. Because these debates are alive and well, you will find traces of them in virtually all the chapters of this text.

THE NATURE–NURTURE DEBATE. The nature–nurture debate poses the following question: *Are our behaviours attributable mostly to our genes (nature) or to our rearing environments (nurture)?* As you will discover later in this text, this debate has proven especially controversial in the domains of intelligence, personality and psychopathology (mental illness). Many early thinkers, such as British philosopher John Locke (1632–1704), likened the human mind at birth to white paper that had not been written on. Others, following his lead, referred to the mind as a *tabula rasa* ('blank slate'). For Locke and his followers, we enter the world with no genetic preconceptions or preconceived ideas: we are shaped exclusively by our environments (Pinker, 2002).

For much of the twentieth century, most psychologists assumed that virtually all human behaviour was exclusively a product of learning. Nevertheless, the tide has been turning for many decades now. Research conducted by *behaviour geneticists*, who use sophisticated designs such as twin and adoption studies, shows that most important psychological traits, including intelligence, interests, personality and many mental illnesses, are influenced substantially by genes (Plomin, DeFries, Knopik & Neiderhiser 2016). Increasingly, modern psychologists have come to recognise that human behaviour is attributable not only to our environments but also to our genes and their interaction with their environments (Bouchard, 2004; Harris, 2002; Pinker, 2002).

Table 1.6 Types of psychologists, what they do, what they do not do

TYPE OF PSYCHOLOGIST	WHAT DO THEY DO?	FREQUENT MISCONCEPTION AND TRUTH
Clinical psychologist	▲ Perform assessment, diagnosis and treatment of mental disorders ▲ Conduct research on people with mental disorders ▲ Work in colleges and universities, mental health centres and private practice	*Misconception: If you want to become a therapist, you need to earn a PhD in psychology.* ▲ **Truth:** Most (but not all) psychology PhD programs are entirely research-oriented. To become a therapist, you will need to undertake postgraduate study in a recognised clinical psychology program.
Counselling psychologist	▲ Work with people experiencing temporary or relatively self-contained life problems, like marital conflict, sexual difficulties, occupational stressors or career uncertainty ▲ Work in counselling centres, hospitals and private practice (although some work in academic and research settings)	*Misconception: Counselling psychology is pretty much the same thing as clinical psychology.* ▲ **Truth:** Whereas clinical psychologists often work with people with serious mental disorders, most counselling psychologists do not. While non-accredited degree programs may lead to practice as a counsellor, they do not provide a pathway to registration as a counselling psychologist.
School psychologist	▲ Work with teachers, parents and children to remedy students' behavioural, emotional and learning difficulties	*Misconception: School psychology is another term for 'educational psychology'.* ▲ **Truth:** Educational psychology is a substantially different discipline that focuses on helping instructors identify better methods for teaching and evaluating learning.
Developmental psychologist	▲ Study how and why people change over time ▲ Conduct research on infants', children's and sometimes adults' and elderly people's emotional, physiological and cognitive processes and how these change with age	*Misconception: Developmental psychologists spend most of their time on their hands and knees playing with children.* ▲ **Truth:** Most spend their time in the laboratory, collecting and analysing data.
Experimental psychologist	▲ Use research methods to study the memory, language, thinking and social behaviours of humans ▲ Work primarily in research settings	*Misconception: Experimental psychologists do all of their work in psychological laboratories.* ▲ **Truth:** Many conduct research in real-world settings, examining how people acquire language, remember events, apply mental concepts and the like in everyday life.
Biological psychologist	▲ Examine the physiological bases of behaviour in animals and humans ▲ Most work in research settings	*Misconception: All biological psychologists use invasive methods in their research.* ▲ **Truth:** Although many biological psychologists create brain lesions in animals to examine their effects on behaviour, others use brain-imaging methods that do not require investigators to damage organisms' nervous systems.
Forensic psychologist	▲ Work in prisons, jails and other settings to assess and diagnose inmates and assist with their rehabilitation and treatment ▲ Others conduct research on eyewitness testimony or jury decision making ▲ Typically hold degrees in clinical or counselling psychology	*Misconception: Most forensic psychologists are criminal profilers, like those portrayed in popular television series and movies.* ▲ **Truth:** Criminal profiling is a small and controversial (as you will learn in Chapter 15) subspecialty within forensic psychology.
Industrial/organisational psychologists	▲ Work in companies and businesses to help select productive employees, evaluate performance and examine the effects of different working and living conditions on people's behaviour (called *environmental psychologists*) ▲ Design equipment to maximise employee performance and minimise accidents (called *human factors* or *engineering psychologists*)	*Misconception: Most industrial/organisational psychologists work on a one-to-one basis with employees to increase their motivation and productivity.* ▲ **Truth:** Most spend their time constructing tests and selection procedures or implementing organisational changes to improve worker productivity and satisfaction.

evolutionary psychology
discipline that applies Darwin's theory of natural selection to human and animal behaviour

The fact that men spend billions of dollars per year on hair replacement treatments is difficult to square with evolutionary hypotheses suggesting that women prefer bald men. The bottom line: beware of untestable evolutionary explanations.

One domain of psychology that has shed light on the nature–nurture debate is **evolutionary psychology**, which applies Darwin's theory of natural selection to human and animal behaviour (Barkow, Cosmides & Tooby, 1992; Dennett, 1995; Tooby & Cosmides, 1989). It begins with the assumption, shared by William James and other functionalists, that many human psychological systems—such as memory, emotion and personality—serve key adaptive functions: they help organisms to survive and reproduce. Darwin and his followers suggested that natural (and sexual) selection favoured certain kinds of brain–behaviour characteristics (such as maternal care), just as it did physical ones (such as claws, feathers or fur, which also carry their own behavioural implications). The precise pattern of the selective forces that drive the evolution of some body–behaviour attributes is in turn determined by the unique environment and lifestyle of the organism.

Biologists refer to *fitness* as the extent to which a trait increases the chances that organisms that possess this trait will survive and reproduce at a higher rate than competitors who lack it. Fitness, by the way, has nothing to do with how strong or powerful an organism is. By surviving and reproducing at higher rates than other organisms, more fit organisms pass on their genes more successfully to later generations. For example, humans who had at least some degree of anxiety probably survived at higher rates than humans who lacked it because anxiety serves an essential function: it prompts us to avoid impending danger (Barlow, 2000; Damasio & Carvalho, 2013). An evolutionary perspective helps us to realise that, while to a certain extent structure and function can be studied separately, in reality they are never separated.

Some approaches to evolutionary psychology have been highly criticised (de Waal, 2002; Kitcher, 1985; Panksepp & Panksepp, 2000). Many of its predictions are extremely difficult to test. In part, that is because behaviour—unlike the bones of dinosaurs, early humans and other animals—does not leave fossils. As a consequence, it is far more challenging to determine the evolutionary history of anxiety or depression than the functions of birds' wings. For example, two researchers speculated that male baldness serves an evolutionary function because women supposedly perceive a receding hairline as a sign of maturity (Muscarella & Cunningham, 1996). This conjecture seems difficult to square with the fact that male hair replacement is a multi-billion-dollar-a-year industry (de Waal, 2002). Moreover, if it turned out that women preferred men with lots of hair to bald men, it would be just as easy to cook up an after-the-fact explanation for that finding ('Women perceive men with a full head of hair as stronger and more athletic'). Evolutionary psychology may one day prove to be an important unifying framework for psychology (Buss, 1995; Confer et al., 2010), but we should beware of evolutionary explanations that can fit almost any piece of evidence after the fact (de Waal, 2002).

THE FREE WILL–DETERMINISM DEBATE. The free will–determinism debate poses the following question: *To what extent are our behavioural choices able to be freely selected rather than mechanically determined by relevant causal factors?*

Most of us experience ourselves as free to select between alternative courses of action. Fewer truths seem more self-evident than the fact that we are free to choose between different courses of action at each moment. For example, 'Shall I order the steak and salad or the vegetarian moussaka?'. The conscious sense of freedom is inescapable even for the most hardened determinist. Indeed, our legal system is premised on the concept of free will. We punish criminals because they are supposedly free to abide by the law, but choose otherwise. One major exception, of course, is the insanity defence, in which the legal system assumes that severe mental illness can interfere with people's free will (Hoffman & Morse, 2006; Stone, 1982). Some prominent psychologists agree that we all possess free will (Baumeister, 2008). Yet many others maintain that free will is actually an illusion (Bargh, 2008; Bayne, 2006; Wegner, 2002).

In an astonishing experimental investigation of willed action, neuroscientist Benjamin Libet (1985) asked participants to lift a finger whenever they wished. He also asked them to note (and later report) using a specially devised electronic clock (called a Wundt clock) the time at which they became consciously aware of forming their intention to move. At the same time, Libet used electrodes placed to measure a brain wave known as the *readiness potential* (RP). This brain wave measures preparation in the premotor cortex for the impending execution of a motor command (action). Remarkably, Libet found that the RP starts up about 300 milliseconds (about a third of a second) before our self-reported conscious awareness of the

intention to move our finger. If you move the index finger of your right hand right now (go ahead, try it), you will almost certainly perceive that movement as (freely) initiated by your conscious intention. Yet Libet's work strongly suggests that unconscious neurophysiological processes in the brain have begun preparing for this action before you are aware of your conscious intention to act (see Figure 1.9).

Libet interpreted his results as showing that the role of consciousness in regulating action was not to initiate behaviour but to monitor behaviour and veto actions that contravened consciously held goals and values. He jokingly called his position a 'theory of free won't' as opposed to a 'theory of free will' (Libet, 2004). Recently, the New Zealand philosopher of mind Tim Bayne has drawn on the latest neuroscience research on the experience of volition to propose (echoing Libet) that our sense of volition is a perception of action rather than a cause of our actions (Bayne, 2011). Bayne proposes that, like any perception, our sense of volition can sometimes be faulty, but argues that on some if not most occasions it can be an accurate representation of our internal states (that is, our intentions actually did cause our actions).

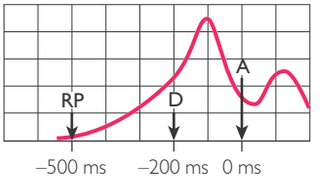


Figure 1.9 Is free will imaginary? The work of Benjamin Libet shows that our brain begins to ready itself to perform a movement about a third of a second—note the difference between 500 and 200 milliseconds (ms)—before we are even aware of our intention to do so. 'RP' stands for readiness potential; 'D' for the conscious decision to perform an action, in this case lifting our finger; and 'A' for the action itself.
(*Source:* Adapted from Libet, 1985.)

How psychology affects our lives

As you will discover throughout this text, psychological science and scientific thinking offer important applications for a variety of aspects of everyday life. Psychological scientists often distinguish basic research from applied research. **Basic research** examines how the mind works, whereas **applied research** examines how we can use basic research to solve real-world problems (Nickerson, 1999). Within most large psychology departments, we find a healthy mix of people conducting basic research, such as investigators who study the laws of learning, and applied research, such as investigators who study how to help people cope with the psychological burden of cancer.

basic research
research examining how the mind works

applied research
research examining how we can use basic research to solve real-world problems

APPLICATIONS OF PSYCHOLOGICAL RESEARCH. Examples abound of how psychological research has affected our everyday lives. Many of us have encountered these applications, although we may not realise that they emanated from psychological research. Below, we look at a sampling of them; you can discover more about these and other examples on the American Psychological Association (APA) website at www.psychologymatters.org.

- As a car driver, have you ever had to slam on your brakes to avoid hitting a driver directly in front of you who stopped short suddenly? If so, and if you managed to avoid a bad accident, you may have John Voevodsky to thank. For decades, cars had only two brake lights. In the early 1970s, Voevodsky hit on the idea of placing a third brake light at the base of cars' back windshields. He reasoned that this additional visual information would decrease the risk of rear-end collisions. He conducted a 10-month study of taxis with and without the new brake lights, and found a 61 per cent lower rate of rear-end accidents in the first group (Voevodsky, 1974). As a result of his research, all new cars now have three brake lights (www.apa.org/research/action/brake.aspx).
- To get into university, you probably had to take one or more tests, like the HSC (Higher School Certificate) or VCE (Victorian Certificate of Education). If so, you can thank—or blame—psychologists with expertise in measuring academic achievement and knowledge, who were primarily responsible for developing these measures (Zimbardo, 2004). Although these tests are far from perfect predictors of academic performance, they do significantly better than chance in forecasting how students perform at university (Geiser & Studley, 2002).
- If you are anything like the average person in modern economies, you see more than 100 commercial messages every day. The chances are high that psychologists had a hand in crafting many of them. The founder of behaviourism, John B. Watson, pioneered the application of psychology to advertising in the 1920s and 1930s. Today, psychological researchers still contribute to the marketing success of companies. For example, psychologists who study magazine advertisements have discovered that human faces on the left side of pages better capture readers' attention than on the right side of pages. Written text, in contrast, better captures readers' attention on the right side of pages rather than the left (Clay, 2002).

A classic simultaneous eyewitness line-up. Although police commonly use such line-ups, most research suggests that they are more prone to error than sequential line-ups.
Fat Chance Productions/Corbis

- Hopefully, you will not be a victim of a violent crime, although you may know someone who has been. Police officers often ask victims of such crimes to select a suspect from a line-up. When doing so, they have traditionally used *simultaneous line-ups*, in which one or more suspects and several decoys (people who are not really suspects) are lined up in a row, often of five to eight individuals. These are the kinds of line-ups most often seen on television crime shows. Yet psychological research generally shows that *sequential line-ups*—those in which victims view each person individually and then decide whether he or she was the perpetrator of the crime—are more accurate than simultaneous line-ups (Steblay, Dysart, Fulero & Lindsay, 2003; Wells, Memon & Penrod, 2006; Wells & Olson, 2003). As a result of this research, police departments around Australia (and throughout the world) now use sequential rather than simultaneous line-up methods.

So, far more than most people realise, the fruits of psychological research are all around us. Psychology has dramatically altered the landscape of everyday life.

Stop and think

Can you think of other ways that psychological research can be applied to our everyday lives?

Evidence-based practice

The central controversy in the profession of psychology today lies in the domain of clinical practice. The principal fault line is between psychologists who believe that clinical practice should base itself on scientific findings and seek evidence for the effectiveness of chosen interventions and those who believe that clinical practice should primarily reflect the unique experience of the individual clinician and client (Dawes, 1994; Lilienfeld, Lynn & Lohr, 2003; McFall, 1991). The historical cleft between these two groups of psychologists is sometimes called the **scientist–practitioner gap** (Fox, 1996). In contrast, the scientist–practitioner model, which is the foundation of this book, sets out to bridge this gap by developing practice grounded in knowledge and practitioners able to contribute to psychological knowledge through a scientific approach to their professional experience.

scientist–practitioner gap
divide between psychologists (predominantly academic) who believe that clinical practice should primarily be a science and those clinicians who believe that clinical practice should primarily be an 'art'

Constance Muriel Davey OBE was the first female president of the Australian Psychological Society.
State Library of South Australia. SLSA: B 11227

Psychology and psychologists in Australia

The Australian Psychological Society (APS) was founded to represent the interests of the profession in 1944. Initially a branch of the British Psychological Society, the APS became an independent society in 1966. Today, Australia has over 35 000 registered psychologists (Psychology Board of Australia, 2017). To give you a sense of how much the field has grown, there were only 54 APS members in 1945, of whom 10 were women (Cooke, 2000). Current members are spread across nine professional college divisions, spanning neuropsychology, clinical psychology, community psychology and counselling psychology, as well as educational psychology, developmental psychology, forensic psychology, organisational psychology and sports psychology (see www.groups.psychology.org.au/colleges). In addition, the APS currently has 40 special-interest groups operating across diverse areas of psychological practice. People with degrees in psychology work in a remarkably diverse array of settings, and the profession of psychology is making a vital contribution to Australian society.

In Australia, the APS has adopted the scientist–practitioner model as the basis of psychological research, professional training and professional practice. In this model, each component is a part of an integrated profession, with responsibility towards the profession as a whole falling upon all who work in its component parts. Thus, education for professional practice requires a thorough knowledge of the core theories, findings and research methods

that constitute the science of psychology. It is this conceptual foundation that the student later learns to apply to the practical problems of psychological practice. Finally, the student is taught the specific procedures and techniques developed and tested within the science of psychology for effective practical intervention in their area of professional specialisation.

This structure is followed by all degree progressions (programs) that are accredited to lead to registration to work as a psychologist in Australia. For those considering a professional career in psychology, this text seeks to provide a secure foundation for the first rung of the ladder of scientific and professional development based on the scientist–practitioner model. Along with a foundation in scientific psychology, this book aims to develop the mindset that is central to the scientist–practitioner model. This includes a commitment to testing ideas and practices against the best available evidence, continuous critical appraisal of one's own ideas and beliefs, and a ceaseless effort to increase the sphere of psychological practice based on scientific knowledge and evidence. It is our hope that readers of this book will develop a critical perspective towards both the foundations of psychological science and the professional practice of psychology.

In the APS-adopted scientist–practitioner model, education for professional practice requires a thorough knowledge of the core theories, findings and research methods that constitute the science of psychology.

Courtesy of APS

Summary: Science and pseudoscience in psychology

1.1: What is psychology? Science versus intuition

1.1a Define psychology.

Psychology is the scientific study of the mind, brain and behaviour. Although we often rely on our commonsense to understand the psychological world, our intuitive understanding of ourselves and others is often mistaken. Naive realism is the error of believing that we see the world precisely as it is. It can lead us to false beliefs about ourselves and our world, such as believing that our perceptions and memories are always accurate.

1.1b Explain the importance of science as a set of safeguards against biases.

Confirmation bias is the tendency to seek out evidence that supports our hypotheses and to deny, dismiss or distort evidence that does not. Belief perseverance is the tendency to cling to our beliefs despite contrary evidence. Scientific methodology consists of a set of safeguards against these two errors.

1.2: Psychological pseudoscience: imposters of science

1.2a Describe psychological pseudoscience and distinguish it from psychological science.

Pseudoscientific claims appear scientific but do not play by the rules of science. In particular, pseudoscience lacks the safeguards against confirmation bias and belief perseverance that characterise science.

1.2b Identify reasons we are drawn to pseudoscience.

We are drawn to pseudoscientific beliefs because the human mind tends to perceive sense in nonsense and order in disorder. Although generally adaptive, this tendency can lead us to see patterns when they do not exist. Pseudoscientific claims can result in opportunity costs and direct harm due to dangerous treatments. They can also lead us to think less scientifically about other important domains of modern life.

1.3: Scientific thinking: distinguishing fact from fiction

1.3a Identify the key features of scientific scepticism.

Scientific scepticism requires us to evaluate all claims with an open mind, but to insist on compelling evidence before accepting them. Scientific sceptics evaluate claims on their own merits and are unwilling to accept them on the basis of authority alone.

1.3b Identify and explain the text's six principles of scientific thinking.

Six key scientific thinking principles are extraordinary claims, testing predictions, Occam's razor, replicability, ruling out rival hypotheses and correlation versus causation. Replicability has assumed particular importance over the past decade in light of the realisation that certain psychological findings are challenging for independent investigators to reproduce.

1.4: Psychology's past and present: what a long, strange trip

1.4a Identify the major theoretical frameworks of psychology.

Five major theoretical orientations have played key roles in shaping the field. Structuralism aimed to identify the basic elements of experience through the method of introspection. Functionalism hoped to understand the adaptive purposes of behaviour. Behaviourism grew out of the belief that psychological science must be completely objective and derived from laws of learning. The cognitive view emphasised the importance of knowledge (or information) processes in understanding behaviour. Psychoanalysis focused on conflicts and unconscious motivations as causes of (neurotic) behaviour.

1.4b Describe different types of psychologists and identify what each of them does.

There are many types of psychologists. Clinical and counselling psychologists often conduct therapy. School psychologists develop intervention programs for children in school settings. Industrial/organisational psychologists often work in companies and business and are involved in maximising employee performance. Many forensic psychologists work in prisons or court settings. Many other psychologists conduct research. For example, developmental psychologists study systematic change in individuals over time. Experimental psychologists study learning and thinking, and biological psychologists study the biological basis of behaviour.

1.4c Describe two great debates that have shaped the field of psychology.

The two great debates are the nature–nurture debate, which asks whether our behaviours are attributable mostly to our genes (nature) or our rearing environments (nurture), and the free will–determinism debate, which asks to what extent our behaviours are freely selected rather than caused by factors outside our control. Both debates continue to shape the field of psychology.

1.4d Describe how psychological research affects our daily lives.

Psychological research has shown how psychology can be applied to such diverse fields as advertising, public safety, the criminal justice system and education.

1.4e Explain how evidence-based practice can help bridge the scientist–practitioner gap.

The scientist–practitioner gap refers to conflicting models of practice in clinical psychology rooted in the differing orientations of clinical practitioners in private practice and academics working in research settings. The former consider psychotherapy to be an 'art' of unique personal interaction, while the latter consider it to be an applied science. Evidence-based practice seeks to bridge this gap by building an evidence base to evaluate psychological interventions, which combines the findings of academic researchers and the rigorous single case study methods in which individual practitioners evaluate the effectiveness of each intervention.

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Answers to Fact or fiction?

Page 7 Academic psychologists are more sceptical of many weakly supported claims, such as extrasensory perception, than are their colleagues in more traditional sciences, such as physics and chemistry.

Fact. Compared with physicists, chemists and biologists, psychologists are considerably less likely to believe that extrasensory perception is an established scientific phenomenon (Wagner & Monnet, 1979). That may be because psychologists are more aware than most other scientists of how biases can affect the interpretation of ambiguous data.

Page 15 Conspiracy theories can lead us to believe two logically inconsistent things at the same time.

Fact. Research shows that many of the same people who are convinced that Princess Diana (who died in a car accident in Paris in 1997) was the victim of an intentional murder plot are also certain that she faked her own death and is still alive (Wood, Douglas & Sutton, 2012).