In the early 1980s, a resident of central Florida—a married man and regular commuter—set out to drive to work on a typical sunny, hot and steamy day. Everything was as normal except that his wife asked him to drop off their young child at a nursery on the way to work: something he rarely did. The child fell asleep in the back of the car and, preoccupied with his business problems, the man entirely forgot that she was there, parked his car in the Florida sunshine and went into his office. A couple of hours later, he realised what had happened and rushed to his car. Too late—the child was dead. This is a true story. I was on sabbatical leave at the University of Florida at the time and these events were reported in the local press.

How could such a tragedy happen? There was no reason to believe that this man was mentally disturbed in any way, nor any less caring than the average devoted parent. He had a normal human mind. Indeed, the really frightening aspect of this story is that it could have happened to any of us. We can all probably recall similar, but less costly, errors of this kind. For example, we may decide to drop off a letter on the way to work, which necessitates a change in route, but drive straight past the junction where we should have turned, as we plan our busy day ahead. On one occasion, some years ago, my wife asked me to drop her into town on my way in to the university, on a day when I was much preoccupied with the organization of a local conference. She waited at the front of the house while I fetched the car from the garage at the back. However, I never picked her up but drove straight into work, unable to keep track of my conscious intention even for a couple of minutes.

But surely such cognitive failures rarely lead to disastrous results? Not so. For example, the hot car story is far from an isolated incident. ABC News (July 2007) reported the following:

Kevin Kelly is a law-abiding citizen who, much distracted, left his beloved 21-month-old daughter in a sweltering van for seven hours. Frances Kelly had probably been dead for more than four hours by the time a neighbour noticed her strapped in her car seat.

According to the same source 340 children died in hot cars in the previous 10 years in the United States alone. Paradoxically, safety legislation requiring
young children to be secured in the back seats of cars has exacerbated the problem, as they are then more easily forgotten. Sometimes the parents were prosecuted but the cases engendered much debate about whether they were legally responsible. No sane and loving parent would put their business problems ahead of the life of their own child. And yet, on many occasions, this is exactly what people appear to do.

In such cases, we may say that we are preoccupied or absent-minded. That such absent-mindedness can have serious, even fatal, consequences gives us some clues as to the divided nature of the normal human mind. Common sense—or what is often described as ‘folk psychology’—may tell us that we have but a single mind, an ‘I’, that is in control, making rational decisions to achieve our consciously held desires and intentions. Most of the time, we can maintain the illusion, and it most definitely is an illusion, that this is how our minds and those of our fellow human beings actually work. But if we are absent-minded, if our minds are elsewhere then exactly who or what is in control of our behaviour? When conscious attention is diverted, habitual behaviour takes over. But habits are part of our mind as well, just a different part.

The modern discipline of ‘cognitive psychology’ is concerned with the nature of mental processes such as perception, attention, learning, memory, language, reasoning and decision-making. The more one studies these topics, the more apparent it becomes that the processes that underlie the bulk of these functions must be partly or wholly unconscious. What is involved, for example, when we understand a sentence spoken to us in conversation? The speaker vibrates air molecules into wave patterns that are detected by the tympanic membranes of our inner ears. These are then translated into electrical signals that are transmitted via the auditory nerve to primary reception areas in the brain and from there to other regions for linguistic and semantic processing. Somewhere en route to consciousness, phonemes, syllables and grammatical structure emerge as does an analysis of meaning that ultimately takes into account all relevant knowledge that the context evokes. All this takes place in ‘real time’, allowing rapid and meaningful conversational exchanges to occur.

Now how much of all this amazing sequence of cognitive processing, which we are as yet unable to reproduce in the world’s most powerful computers, is actually conscious? Can ‘we’, our conscious selves, congratulate ourselves on the smartness of this operation? Not really; we cannot, for example, explain to researchers in artificial intelligence how we actually do this, so that they can try to program their computers with same methods. In fact, all we are really aware of is the meaning of utterance we have heard and, if we attend to it, some characteristics of the sound, such as timbre and pitch of the voice, and gender of the speaker. Even our ability to recall the actual words stated, as opposed to
their gist, or essential meaning, will be rapidly lost from our memories, especially if utterances are lengthy or followed by other statements from the speaker.

In this book, I am not concerned with everything that the brain does. There will be no discussion of the processes that control our digestion and blood sugar levels. The term ‘mind’ refers to those aspects of the brain that in some way represent the external world in which we find ourselves, and determine our behaviour within it. Even this definition is too broad for the current purposes, however. I will not, in fact, discuss in any detailed way how the brain processes visual information, or how it constructs the meaning of spoken sentences. To propose that such processes are automatic and unconscious is neither interesting nor controversial. I doubt that anyone would claim that they could explain the mechanism of the visual system by introspection. The focus here is instead on ‘higher’ functions of the brain that control our behaviour: everything from getting out of bed in the morning to learning to play a musical instrument; from putting on our shoes to writing a literary masterpiece. In essence, everything that defines us as biological, social and cultural creatures. Surely we are in control of these functions. Or are we?

The claim I shall explore is that there is no singular human mind in control of such higher functions. In the past 20 years, there has been a major growth of psychological research into the ‘dual processes’ that apparently underlie our learning, thinking, decision making and social judgements. One kind of process (type 1) is described as fast, automatic and capable of processing large amounts of information at the same time. The other (type 2) is slow, sequential and limited in processing capacity but also appears to be under conscious control. What I am calling the ‘two minds hypothesis’ is based on the idea that there are two quite distinct cognitive systems underlying type 1 and 2 cognitive processes, in effect two minds within one brain. On this basis, there are two ways of knowing, two ways of believing, two ways of thinking and two ways of acting. The mere observation that much working of the brain must be unconscious is beyond controversy. The two minds hypothesis is much stronger, however. It undermines our common sense belief that we (conscious people) are necessarily in control of our own behaviour.

The two minds hypothesis

Broadly, there are two ways that we can think about the fact that much of our mental function is unconscious. The first of these, the chief executive model, is compatible with common sense or folk psychology and the way we like to think about ourselves as conscious beings in control of our behaviour (see Figure 1.1). The philosophical position known as dualism, famously espoused
by Decartes, is largely discredited in contemporary philosophy (see Chapter 7). Dualism involves the idea that the mind and body are separate, whereas the vast majority of cognitive scientists subscribe to the view of monism or materialism, in which the mind is simply considered to be the functioning of the brain. However, I contend that ordinary people think implicitly about minds and bodies in a dualistic manner, regardless of whether they hold explicit religious beliefs about souls or life after death. Essentially, we think of ourselves as conscious persons who inhabit our bodies and are in some way separate from them. Of course, there is no scientific foundation for this dualism at all; the conscious person is a construction of the brain, whose properties may be illusory. Part of this construct is the belief in intentional cognition or conscious will. It appears to us that we freely chose our actions, after reflection on our beliefs, desires, goals and intentions. For example, I chose to write this book because I believed that this was an important scientific topic that deserved a wider audience and I wanted to be the one to communicate it.

It is easy to demonstrate that much of the information processing carried out by the brain is not accessible to the conscious person. However, this can easily be reconciled with our common sense intuition that the conscious person is in charge. I call this the chief executive model of the mind and illustrate it in Figure 1.1. Imagine that the chief executive of a large corporation sits in the penthouse suite of his skyscraper building, never visiting the lower floors in which his many subordinates work. His minions feed him the information he demands, wait for his decisions, and then carry out his instructions.
While all the hard work is done at the lower levels, he is still the boss, still calling the shots. This, I believe, is the way that our everyday folk psychology deals with the idea of unconscious processing in the brain. The conscious person is the executive mind, calling on various support systems within the brain to do its bidding. We are not aware, for example, of the means by which our brains construct images from perceptual input, retrieve knowledge from memory or extract the meaning of sentences. However, we see the purpose of such unconscious systems to be the creation of content for the executive mind, in the form of beliefs about the world. They are the workers who prepare and place the relevant papers in our in-tray. For example, if you make a tactless comment, you do not need access to the processes of social perception which enable you to see that you have upset your friend; you just need to know that she is, in fact, upset. The presence of this knowledge in your conscious mind is sufficient for you to make an appropriate decision for action, say, to apologise. Just as the chief executive of a large corporation does not need to know the detailed methods by which his or her subordinate staff work, neither does the conscious executive mind need to know the details of low level control processes. He or she is still the boss, still in charge of the big decisions.

The chief executive model is superficially attractive and I shall refer to it from time to time as an alternative to the two minds hypothesis. However, it cannot be right for a number of reasons that will become apparent in this book. By contrast, the two minds hypothesis (Figure 1.2) departs radically from common sense. Here we distinguish a reflective mind from an implicit...

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**Fig. 1.2** The two minds model.
intuitive mind. The reflective mind does get to control some of our behaviour, but far less than folk psychology would lead us to believe. Most actions are controlled intuitively without any awareness of the cognitive processes involved. In this account, the reflective mind feels like the all-controlling executive mind to its owner, but this is largely illusory. In reality, it competes for control of behaviour with the intuitive mind, often unsuccessfully. Moreover, the two minds have access to different kinds of knowledge: explicit memory for the reflective mind and implicit memory for the intuitive mind. We still need unconscious support systems for learning, perception, etc. for both minds, but I have deliberately not drawn the links in Figure 1.2. As we shall see in Chapter 3, there is evidence that perceptual systems have both conscious and unconscious routes to behaviour, and that there are both explicit and implicit forms of learning and memory.

If the two minds hypothesis is right, then our common sense is wrong. The reflective mind does consciously control some of our behaviour, some of the time. However, when the intuitive mind takes charge, which it often does, then the reflective mind only thinks it is in control. In fact, one of the major functions of the reflective mind is confabulation. In other words, we (conscious beings) make up stories to maintain the illusion that we are the chief executive who is really in control. We may, for example, vote for a right wing political party because of unconscious motivations. Perhaps we aspire to be rich and powerful (even though we are not) and our intuitive minds have associated such people with right-wing politics. This association delivers an intuitive feeling of rightness in voting for the party but without any conscious awareness of its basis. When an opinion pollster (or a drinking partner) asks us to give reasons for our voting intentions, the reflective mind confabulates an answer. We say, for example, that we believe that they are more competent at handling the economy, a theory conveniently delivered by the newspaper we read. This argument may convince the pollsters, colleague and indeed ourselves, but it is not the actual reason for our voting behaviour.

Many psychologists try to capture the distinction between two minds in terms of actions that are controlled with and without conscious awareness and intention. The issue of consciousness is important and will be discussed in detail in Chapter 7. However, the distinction between the reflective and intuitive minds cannot simply be termed as one between conscious and unconscious thinking. As indicated above, there must be unconscious support systems for both minds. The reflective mind cannot be wholly conscious, because many preconscious processes affect its content. What we are aware of at a given time depends, for example, on mechanisms which determine our attention. If a dog runs in front of our car while we are driving, our attention
will immediately switch to the road and the dog, and away from the play we were listening to on the radio. Some mechanism, by definition preconscious, must be monitoring our routine driving behaviour and is able to alter us when conscious attention is required. The same is true of beliefs and memories that are evoked in particular contexts. If we meet an old friend, memories of our previous meeting or beliefs about her personality that come to mind may inform our decisions about what to say or do. But the mechanisms that identified and retrieved these memories cannot themselves be conscious.

If the reflective mind cannot be entirely conscious, then the intuitive mind cannot be entirely unconscious either. The latter has access to both emotions and what I call ‘cognitive feelings’, which result in conscious experiences. When we choose intuitively, we often have a feeling of confidence or rightness in the choice, even though we have no access to the underlying process. That is why we can usually tell the opinion pollster which party we will vote for, even though we are not conscious of the actual reasons for this ‘intention’. There is also much psychological evidence, however, that our intuitive feelings of confidence or rightness can be unreliable. Such feelings may be based on poor grounds, such as stereotypes, that would be rejected by the reflective mind if it knew their basis. Say we are prejudiced against a male candidate for a job that is stereotypically considered female. Our reflective minds will seek and find conscious reasons to support our prejudice. Thus it will appear to us that his experience was less relevant or his interview performance less convincing than that of the female candidates. It is also hard to argue that the intuitive mind is wholly unconscious because we can become aware of conflict between the two minds. This is particularly true of compulsive behaviours that include behavioural addictions, such as gambling, and neurotic problems such as obsessive-compulsive disorder or phobias. The intuitive mind may compel us to continue gambling or to avoid flying, in spite of the reflective mind’s explicit goals to the contrary. We can and often do become aware of such conflict.

So we can see that none of the brain processes that control our behaviour can be wholly conscious and few are wholly unconscious. We can say that brain processes are conscious only in the sense that some aspect of those processes registers consciously. For example, we may say that we have made a conscious decision to stay home this evening rather than go out to the pub to meet friends. We are certainly conscious of such a decision and can tell others what it is. That does not mean, however, that all the cognitive processes involved in the decision were conscious. Even when we reflect on a decision, the thoughts that come to our mind must be delivered by some preconscious mechanism. Memories and beliefs that appear relevant come to mind in reflective thinking but cannot be consciously willed to do so. We don’t even know
what we know. Similar problems attach to the idea of unconscious decision making. Suppose that we swerve our car when an unexpected hazard appears on the road, such as a driver unexpectedly overtaking towards us. Such actions can occur very rapidly without any time for conscious reflection, but we cannot say that they are wholly unconscious. We are certainly conscious of aspects of this process: an experience of fear, for example, and a visual perception of the hazard even if it follows our action of turning the wheel (see Chapter 3).

One apparent solution to this problem might be to distinguish mental processes that are automatic (in the intuitive mind) from those that are controlled (in the reflective mind). This terminology has also been popular with researchers in both cognitive and social psychology. However, these terms like unconscious and conscious again capture only part of the two minds hypothesis. The idea here is that behaviour is controlled if the conscious self is aware of and intending it; otherwise it is automatic. Now, it is true that we can assume conscious control of some actions while leaving others on automatic pilot. While I write this, for example, I am conscious of the meaning of what I want to say but not on the construction of the sentences (largely an unconscious process) and still less on the movements my fingers need to make to type the text in to my computer. But if I need to type in an unfamiliar symbol, the typing process will suddenly become conscious and controlled. Likewise, if I am having a conversation in a crowded room and someone across the room says my name, my attention will immediately switch to the other conversation, even though I was not consciously hearing it. So it was not ‘I’ who heard my name and it was not ‘I’ who decided to switch attention. So it cannot really be ‘me’ (the conscious self) who is in control!

The two minds hypothesis really concerns higher order control of behaviour such as that involved in decision-making. Decisions can be made intuitively and also reflectively (see Chapter 4). Intuitive decisions are made because they feel right, but without consciousness of their basis. Such decisions are quick and require little effort. Few people would reflect when offered a choice of tea or coffee, for example. They just go on habit or whim. Reflective decisions, on the other hand, are made with conscious thought about the options available and their likely consequences. We tend to decide reflectively when decisions are very important (whether to accept a job offer or make an offer to buy a house) but also when they are novel. When a choice is unfamiliar, intuition may not help us. This essentially is the basis for the terms ‘intuitive’ and ‘reflective’ minds. However, the two minds hypothesis involves a lot more than the proposal that there are two modes of decision-making, which might simply reflect one mind operating in two different ways. Two minds implies two distinct systems for knowing, thinking and acting within one brain. If this is true,
then there must be neurologically distinct areas of the brain underlying the
two minds. There must also be some evolutionarily plausible story about how
this came about. The argument generally given is that the intuitive mind is old
and animal-like, while the reflective mind is recently evolved and distinctively
human (see Chapter 2). So I will also refer to them at times as the old and the
new mind.

While neurological evidence and evolutionary arguments will be examined
in this book, the bulk of the evidence for two minds comes from experimental
psychology. For example, there is evidence for distinct systems of learning and
memory (Chapter 3) and conflict within individuals in the ways in which they
reason and make decisions (Chapters 4 and 5). These topics fall within the
domain of ‘cognitive psychology’ discussed later in the chapter. Social psychol-
ogy is a separate tradition that involves studying behaviour in a social context.
But much research in this field also supports the two minds hypothesis: for
example, people may hold implicit attitudes and stereotypes that conflict with
their conscious beliefs (Chapter 6) and be completely lacking in insight into
the causes of their behaviour (Chapter 7). I will draw on research from all of
these areas in this book in my quest to explore and test the two minds hypoth-
esis. First, we need some historical perspective.

**Thinking about thinking**

How should we define thinking? What stuff are thoughts made of and what
purpose do they serve? The psychology of thinking has a long history. For
hundreds of years, psychology was part of the discipline of philosophy, only
establishing a distinct identity in the mid-nineteenth century and thus sharing
much common history with the contemporary philosophy of mind. We can
trace the study of thought itself from the writings of Aristotle about 2,000 years
ago. He clearly believed that thinking was the conscious activity of the mind,
an idea that remained essentially unchallenged in philosophy and psychology
until about the end of the nineteenth century. He also established a methodol-
ogy for studying thought that has dominated until the past 100 years or so: the
introspective method. After all, if the mind consists of conscious thoughts,
who can study them but their owner? The mind must look inward for answers,
it was thought, and for centuries it was the minds of the philosophers that
studied themselves.

Aristotle developed a rudimentary but clearly psychological theory of think-
ing. He believed that thought was made of ‘images’. For example, an image
might be a mental picture of the face of someone who is not currently present.
The image you can conjure up is in some ways similar to the experience you
had when you looked at that person. It was viewed as reproduction of a past
sensation (sensory experience). Aristotle supposed that you could store away the mental pictures you had when seeing an object, rather like a photograph in an album, and then recall them as images at a later time. These ideas were developed by the British Empiricist school of philosophers in the seventeenth and eighteenth centuries. They concerned themselves with describing the order and organisation of the images that make up our thoughts. Why, they wondered, did the particular images come to mind at particular times and why did one follow another? Their theory was based upon an association of ideas. One idea (image) follows another because they are associated in some way: by the fact that the two things are normally seen together, or due to some related meaning. Empiricist philosophy was based on the idea that all knowledge and thought was derived from experience and learning, starting out with the infamous tabula rasa or ‘blank slate’ proposed by the philosopher, John Locke: a philosophical anticipation of the behaviourist psychology that later dominated early twentieth-century thinking. The alternative position known as nativism proposes that knowledge is innately present in human beings. This was espoused by Descartes and is echoed in much later twentieth-century thinking. Innate knowledge is a key idea in evolutionary psychology, as discussed in Chapter 2.

Association does indeed play an important role in thinking and remembering in a kind of thought known as ‘daydreaming’. Daydreaming consists of thinking about matters not connected with your current situation: for example, planning your weekend instead of listening to a boring lecture: another form of absent-mindedness. Much of our time is taken up in daydreaming and this kind of thinking often involves what is known as free association. This means that one idea leads to another without any overall purpose or direction. For example, thinking about the trip you are planning at the weekend may remind you that the car needs a service. This may get you thinking about the fact that your previous car was less reliable; then you remember that awful occasion when you broke down on the motorway in pouring rain and so on. While such free associative thought may be common, it has received relatively little attention from experimental psychologists. The bulk of contemporary research instead concerns itself with thinking that is directed towards solving a problem or making a decision. Although association may play a part in directed thinking, it cannot account for it, as we shall see.

When the discipline of psychology emerged from philosophy in the mid-nineteenth century, the subject became an experimental science. I will describe many psychological experiments in the course of this book and an explanation of the language used is needed. Until quite recently, the volunteers who are tested in psychological experiments were described as ‘subjects’. In recent
years, however, this term has been banished by the great and the good who control publication in scientific psychology. In the modern era when all such research is regulated by strict ethical codes and the requirement of voluntary participation, the term ‘participants’ is now preferred. I will follow this convention here, when discussing research of any period. ‘Participants’ are hence the human subjects of the experiment, the volunteers who submit to testing.

The earliest psychological experiments continued initially to define thinking as the contents of consciousness and simply tried to refine the methodology of introspection by using trained observers operating in the laboratory. Such expert participants would be given tasks to perform and asked to report what was going on in their minds. Of particular interest is the work of a group of German psychologists at the University of Würzburg in the early 1900s. The methodology used by the Würzburg psychologists was as follows: the participant (who was often one of the experimenters!) was asked to perform a specific task such as judging which of two weights was heavier or giving word associations. The task would be repeated many times or for a number of ‘trials’ as psychologists term it. After each trial, the participant would describe the thoughts of which they were conscious when performing the task.

What the psychologists expected when they started this research was that thoughts in the form of images would intervene between stimulus and response, in accordance with the then dominant associationist theory of thinking. For example, in a word association task if the experimenter says ‘bacon’ and the participant replies ‘egg’, then a report might be expected of the participant experiencing an image of a plate of eggs and bacon on a breakfast table. In some cases, this is what exactly they found, but more frequently such linking images were not reported. Some participants claimed not to be thinking at all. Others, more mysteriously, claimed that they had thoughts of an indescribable nature. This led to a major debate amongst psychologists at the time about whether there were ‘imageless thoughts’ in the mind.

If thinking is a conscious process that controls our actions, as folk psychology leads us to expect, then the results of these Würzburg experiments are indeed puzzling. There are actually many problems with the method of introspective report that have been identified in modern psychology (see Chapter 7). For example, can people attend to an external task and their own mental experiences at the same time? Will the contents of consciousness be remembered when a report is taken after the event? However, these were not the only early researchers to discoverer limitations of the introspective method. The great nineteenth-century British psychologist (also geneticist and statistician) Sir Francis Galton set out to study his own mind in a series of systematic introspective experiments. Galton was a flawed genius whose scientific, but not
social thinking, was way ahead of its time. Sadly, he is best remembered now for founding the school of Eugenics that believed in selective breeding to improve human intelligence and other qualities. For all this, he was a man of exceptional brilliance who made many important scientific contributions. It is most interesting that he discovered the limitations of introspection simply by trying to use the method himself, and without any of the evidence that has led modern psychologists to similar conclusions. Galton concluded that consciousness was no more than a ‘helpless spectator’, that most brainwork was automatic and only a fraction of it available to introspection.

The notion of thinking as consciousness was also called into question in the early part of the twentieth century by two contrasting movements: behaviourism and psychoanalysis. Each provided strong challenges to the traditional ways of thinking about the human mind. The school of behaviourism, founded by J. B. Watson, was a form of associationism, but with the association between a stimulus and a response replacing the association of ideas. The idea was to study human behaviour only in terms of what could be objectively observed: the environment to which people were exposed and the behaviours which they produced. Indeed, Watson decreed that the study of conscious thinking by introspection was ‘mentalistic’ and thoroughly unscientific. Watson had a point. Scientific method normally incorporates the principle that observations should be objective and capable of confirmation by independent and disinterested observers. How can this be so, if a person’s mental states are the object of scientific enquiry and only observable to the person who experiences them? This problem remains for those who think consciousness is a proper subject of study for science. You don’t have to be a dualist in order to recognise that mental events have a different character from physical ones. A brain viewed from the inside by its owner looks entirely different from the same brain as seen by an outside observer.

According to Watson, all behaviour, including that which we describe as ‘thinking’, could be explained on the grounds that we learn to associate particular responses or behaviour with particular stimuli or situations, especially when some form of ‘reinforcement’ (reward) is also present to cement the bond. This kind of learning is known as classical conditioning. Watson’s behaviourism was later developed by B. F. Skinner, who in his time was easily the most famous psychologist in the world and whose main emphasis was on operant conditioning. According to Skinner, our behaviour is shaped by our environment. We may generate behaviours initially at random, but those that get reinforced or rewarded will tend to be selected and strengthened whereas those that are not reinforced fade away. This was often demonstrated in animal experiments, such as those designed to show discrimination learning. If there
is a black key and a white key in its cage, a pigeon will quickly learn to peck at the black one if that results in a food pellet, and where pecking the white one would have no reward. There are many experimental demonstrations that both classical and operant conditioning are real phenomena in people as well as animals. For radical behaviourists, this was sufficient to explain all behaviour: mental states were no more than descriptions of behavioural propensities. As the old joke goes, when one behaviourist meets another, he greets his friend with the comment, ‘You are fine. How am I?’

Mentalism and behaviourism both ultimately failed as psychological theories because each concerned themselves only with a part (in this case, a different part) of the human mind. It is true, as common sense would have it, that we have conscious beliefs, desires and intentions, and that a psychological account of our behaviour in these terms may sometimes account successfully for what we do. It is also true, as behaviourism would have it, that we acquire many habits and low-level conditioned responses from our experiences in the world and that an analysis at this level can be successful in accounting for some of our behaviour. It is not true that either of these psychologies on their own can do the job. In essence, behaviourists were limiting their study to the intuitive mind. Mentalists, by contrast, were attempting to study only the reflective mind, but with the dubious method of introspection.

One strength of mentalism is also a fatal flaw for behaviourism. Behaviourists cannot account for the fact that much of what we do is driven by an intention or purpose. Consider again a commuter’s habitual drive to work. At a particular road junction, say, our traveller normally turns left. A behaviourist would say that she has learnt an association linking the ‘stimulus’ of the road junction to the ‘response’ of turning left. Suppose that one day on her way to work, she needs to buy a newspaper. Such a deviation from established habits can have many causes. Let us say in this case that her daughter’s photograph is to be published in a local newspaper that she would not normally buy. Visiting the newsagent requires a small diversion, in fact a right turn at the junction. To the watching behaviourist who does not know that she has the intention of buying a paper that day, her behaviour would be baffling. Everything would appear normal as she leaves her house, all responses being given in the usual way to stimuli, until she arrives at the junction. Suddenly, the behaviour reverses its normal pattern.

Of course, someone could have told the behaviourist that she was going to buy a newspaper on her way to work, but such mentalistic data are of no legitimate use to him as his theoretical system has no use for such concepts as goals, intentions, beliefs or desires. An account in terms of the conscious goals and intentions of the commuter would, of course, predict the change in routine.
However, there is much that could not be explained in this way. For example, why is the majority of the commuter’s drive to work so automatic and effortless that she may be able to devote her conscious resources to entirely different matters, such as planning a holiday for the following month? And why, if she is not sufficiently alert, might she drive straight past the newsagents *in spite of* a conscious intention to buy the paper.

This example shows clearly that thinking is more than just learning associations and that much of a person’s behaviour can only be understood if we know their intention or purpose. Behaviourism was, however, enormously successful in psychology, and was the dominant theory from the 1920s through to the late 1950s. It was also one of several influences which led to the loss of faith in introspection and the idea of thinking as a conscious act. Another, very different influence was that of the school of psychoanalysis associated with Sigmund Freud. In common with behaviourism, psychoanalysis questions the belief that our actions are caused by our conscious thoughts. Freud believed that much of our behaviour was caused by *unconscious* thinking. Freud’s ideas about conscious and unconscious thinking were very different from those of a modern cognitive psychologist. However, his ideas were historically significant in undermining confidence in the traditional view that we need look no further than the contents of consciousness in order to understand human behaviour.

Freudian theory is regarded by most modern psychologists as unscientific because many of the proposals he made, for example, concerning the interpretation of dreams, cannot be tested by experiment. That is to say, one cannot see how the theory could be *disproved* by any observation that can be made. However, the ideas that Freud discussed have had a profound and lasting influence. Freudian theory includes the notion of an unconscious mind. He believed that much human behaviour was motivated by desires and fears that were *repressed*, i.e. kept out of consciousness because they were too painful or socially tabooed. Our conscious beliefs about the causes of our own actions are, according to this view, often *rationalisations*. For example, a man may cross the road to avoid passing a place where a traumatic incident took place such as a serious quarrel leading to the breakup of a relationship. When asked why he crossed the road, however, an explanation might be offered in terms unrelated to this incident. He may reply, for example, that he noticed an interesting display in a shop window and wanted to look at it. The notion of rationalisation or ‘confabulation’ in conscious thinking will be a key theme in this book (see especially, Chapter 7). However, in common with most modern psychologists there is much in Freudian theory that I would not accept. In particular, while most workings of the mind are unconscious, this is not
(mostly) for reasons of motivation and emotion. There is simply far more computational work for the mind to achieve than can be performed by the highly limited flow of conscious thought.

In summary, although thinking was traditionally equated with consciousness from the time of Aristotle onwards, the work of psychologists from the late nineteenth century onwards led to serious questioning of this concept. For example, Freudian theory promoted the idea of unconscious thinking, and the experiments of early psychologists undermined confidence in the introspective method, used traditionally by philosophers to study thought. The behaviourist school, with all its inadequacies, dominated psychology from the early twentieth century well into the 1950s. Then came a major change: a revolution in psychological thinking. It was caused by the availability of a powerful new metaphor.

**The emergence of cognitive psychology and cognitive science**

In the 1960s, a new and important field of ‘cognitive psychology’ was identified, which has grown rapidly to become a major focus for current research in the subject. The rise of cognitive psychology marked the fall of behaviourism and the development of a completely new way of regarding human thought. Cognitive psychology developed in parallel with the emergence of modern digital computers that provided a new metaphor for the human mind. The subject is founded essentially in the belief that the brain is a kind of computer and that mental activity is the ‘software’ or the many programs that it runs. Thus we see a return to the notion of thinking as an internal mental activity, but now without the assumption that this process is necessarily conscious and open to introspection.

Cognitive science is a more broadly based movement which includes cognitive psychology but also other disciplines, such as linguistics, artificial intelligence, aspects of neuroscience and much contemporary work in the philosophy of mind. Many contemporary philosophers now adopt a ‘computational theory of mind’. In this approach, we can talk of the mind as an information processing system, which represents percepts, concepts and objects in the external world. Like a computer, the brain has software, which can manipulate these representations and draw conclusions from them. In other words, human reasoning is simply computation. In fact, a key belief for most cognitive scientists is that intelligence lies in the software and not the hardware used for computation. In other words, the same intelligent functions may be implemented in biological systems (brains) or machines (computers). This does not, of
course, prevent contemporary philosophers arguing about the way in which
the mind is computational. There are, for example, debates about the extent to
which knowledge may be innate or acquired and whether or not part or all of
the traditional folk psychological concepts such as beliefs, desires and inten-
tions can be retained in such an approach.\textsuperscript{13}

What precisely is a computer? A generally accepted definition is that a com-
puter is a general purpose, programmable, information-processing system. Let
us break that down into its components. First of all an information processing
system (IPS) is anything that processes input information by applying appro-
priate rules in order to produce an output. Many things qualify as IPS that are
not computers. Consider, for example, a thermostat. The input information is
that of ambient temperature and the output that of controlling a central heat-
ing boiler. The input is not wired directly to the output, as in a light switch, and
some information processing takes place. The behaviour of the thermostat
might be described by rules such as the following:

\begin{itemize}
  \item If the temperature exceeds 21 degrees C and the boiler is on then switch the
        boiler off
  \item If the temperature is below 19 degrees C and the boiler is off then switch the
        boiler on
\end{itemize}

This is, of course, an extremely simple example of an IPS. A thermostat is
not a computer because it is not general purpose and cannot be programmed
to do anything else. Calculators are a more interesting case. Calculation is
clearly a form of computation or information processing. An abacus, a
mechanical calculator or a non-programmable electronic calculator are all
clear examples of IPS that are not computers. Again the function of calculators
can be described using rules. For example

\begin{itemize}
  \item If the number 4 is pressed then the “+” sign then the number 7 and
       then the “=” sign then display the answer 11
\end{itemize}

Of course you would need many thousands of rules of this type to describe
the function of even the simplest of calculators; the actual internal design
would consist of something much more efficient. However, the point is that
all computation or information processing can be described using rules that
relate inputs to outputs. A programmable calculator is closer to our idea of a
computer, although we would discount it on the ground that it is not general
purpose.

Any computer can be programmed, in principle, to perform any task of com-
putation that can be devised subject only to limitations of speed and memory.
A program consists of a set of instructions that in a computer of conventional
design are processed in sequence, one after the other. A good way of describing what computers do is that of symbol processing, where symbols can stand for anything. The first major use of computers was for doing arithmetic, but numbers and arithmetic operators are just symbols of a particular kind. A computer does not need to understand what numbers are: it just needs a set of accurate rules that produce the right output symbols corresponding to the input symbols. In the same way, a word-processing program, one of the most used of modern computer applications, has no knowledge of language. A word is just a sequence of letters followed by a space; a paragraph a sequence of such ‘words’ followed by a carriage return. Most word processors now have the ability to check spelling by comparing your letter strings with an in-built library of words. Few can yet check grammar with great accuracy, and none (unfortunately) can extract the meaning of your text and comment on whether it makes sense.

At present, computers perform some tasks much better than we do, for example high-speed arithmetical calculations or accurate storage and fast retrieval of very large amounts of information. However, there are many tasks which computers are currently very poor at performing compared with human beings. A good example is that of understanding the meaning of language, and another that of recognising faces and other visual patterns regardless of distance, orientation, lighting and context. It is a tenet of faith among cognitive scientists that such functions are in principle ‘computable’; that is they could be done by computers if only we had figured out how to write the programs. But we also know enough about the brain now to understand that it is organized in very different way from electronic computers.

Computers have to date been largely serial processing devices that carry out instructions in a sequential manner. By contrast, the brain is known to be massively parallel in design with large numbers of interconnections between brain cells. In other words, our brains can carry out many processes at the same time. Even a particular function, such as vision, involves many neurones that simultaneously process many different features of the environment that are represented in the light patterns that reach our eyes. Given enough time, a serial computer can compute anything that can be computed. However, some tasks (such as pattern recognition) can be solved much more quickly by parallel processing. This helps explain why brains, with their relatively slow biochemical means of transmitting information, can nevertheless rapidly perform complex tasks that currently defeat the world’s most powerful computers.

A matter for great debate within cognitive science is the extent to which the mind acts like a general purpose computer that can be programmed for many tasks, and the extent to which it consists of dedicated computational systems with fixed programming, sometimes known as cognitive modules
(see Chapter 2). Such modules are more analogous to a microprocessor than a computer: that is, a device which is special rather than general purpose and which comes with a fixed set of programs than cannot be re-written. For example, we might regard the visual system, at least at lower levels (detection of colours, contours, movement, etc.) to be ‘hard-wired’ with fixed programming in this sense. On the other hand, given the vast range of different things that people can learn to do, it seems most probable that our brains also contain general purpose systems that can be programmed by experience. What I will be arguing in this book is that the mind contains a number of different computational devices, both special and general purpose, which interact with each other in producing our behaviour.

Cognitive psychology as traditionally practised has its limitations. There is a tendency to talk of brains as though they were disembodied devices lying in vats, whereas they are actually integral parts of bodies capable of perception, action and emotional response. By neglecting emotion, in particular, cognitive psychology leaves out an essential part of what it is to be a sentient being. In recent years, there has been a reaction against this, with movements to study ‘embodied’ cognition and the relationship between emotion and thought. While I focus mostly on cognitive research in this book, I will acknowledge the importance of emotion, especially in the later chapters. Emotions, sensations and bodily experiences play an important role in the feelings arising from the intuitive mind, which often compete with the essentially cognitive processes of the reflective mind. As we shall see, it is often emotions and not thoughts that ultimately control our actions.

In my view, the computational approach of cognitive psychology provides a big advance on both the introspectionism and behaviourism that preceded it and will be the dominant metaphor used in this book. However, it has its limitations that we should recognise. While our brains do indeed seem to compute, they differ from electronic computers in many ways. If they were ‘designed’, it was by evolution not by another human being. They are made of soggy wet stuff that grew together with a body that they cannot do without. Through this body the brain is able to learn by an intense degree of interaction with the environment and to experience emotions through biochemical processes. Most of the functions of the brain seem not to involve consciousness, but if you take consciousness away (even through sleep) there is little behaviour of any interest to observe.

**Questions and challenges for the two minds hypothesis**

I have already indicated that it would be a mistaken simplification to describe the intuitive mind as unconscious and the reflective mind as conscious.
Nevertheless, the issue of consciousness provides a big challenge for the two minds hypothesis and I devote a whole chapter (Chapter 7) to this topic. Psychologists have, in fact, developed several different concepts of the unconscious mind. There is the psychodynamic unconscious, proposed by authors such as Freud and Jung. Then there is the behavioural unconscious, which refers to those aspects of our behaviour that are controlled by conditioning and other forms of learning that appear to take place without awareness. More recently fashionable is the notion of the cognitive unconscious, which refers to computational cognitive processes below the level of conscious awareness and control. But the cognitive unconscious covers a multitude of possibilities: processes that were innately present and provided by evolutionary mechanisms; processes that were acquired by experience without ever becoming conscious; processes that were once conscious but became rapid and automatic through habit and repetition. Some or all of these are parts of what I am calling the intuitive mind. But why is one part of the mind—the reflective mind—different? Why do we have any form of consciousness at all?

Another major issue that has exercised psychologists and philosophers is that of rationality. One definition of rationality is that which compares our behaviour to what we ought to be doing, according to some predefined standard or 'normative' theory. Both academia and popular culture contain two contrasting notions of normative rationality which treat emotion in very different ways (see Chapter 8). One view pits rationality and emotionality as opposites. According to this view, we are rational if we reason in a logically correct and dispassionate manner. Another theory of rationality, however, is that it consists of acting in such a way as to be likely to achieve one’s goals. This is the foundation of standard decision theory (see Chapter 4). But goals are only worth pursuing if they bring satisfaction or pleasure or avoid pain, so it is inherent to this view that rationality requires emotion. This idea defines rationality through the decisions people make.

In the two minds theory, the notion of rationality becomes even more slippery. Typical cases of behaviour that are deemed irrational include those where someone vows to stop smoking, or reduce excessive consumption of alcohol or food and then manifestly fails to do so. If our consciously expressed beliefs and desires to live long and healthy lives, for example, are contradicted by our behaviour then we appear, in the decision theory sense, to be irrational. And indeed we would be so, if the reflective mind were the only level in operation. What such behaviours show is the power of other systems lurking in our brain to subvert our conscious rationality. Physical addictions can overcome our conscious desires as can strong innate drives such as hunger or sexual desire. But violations of decision-based rationality can also occur due to learnt habits, as when we forget our wish to buy a paper on the way to work, or
due to acquired emotional responses such as phobias. A person with an earthworm phobia, for example, may be unable to enjoy a walk in a garden or the countryside.

The two minds hypothesis has arisen from the proposal of numerous ‘dual process’ theories in cognitive and social psychology. As mentioned earlier, each appears to distinguish between type 1 processes that are fast, automatic and high in processing capacity from type 2 processes that are slow, intentional and limited in processing capacity. In fact, there are many different labels that have been given to type 1 and 2 processes, as indicated by the sample of theories listed in Table 1.1. Just because there are lots of such theories, with many labels, it does not mean that the theories are necessarily very different. Some of these authors are working in different fields of psychology that do not usually cross-reference each other. This is particularly true of cognitive and social psychology. Some are focusing on very specific kinds of tasks that they wish to explain. And, of course, scientists have career ambitions like everyone else. It is always good to sound as though you are saying something new!

What I am calling the two minds hypothesis does not belong to any one author. The essential ideas here have been proposed by a number of authors including Arthur Reber, Seymour Epstein, Keith Stanovich, David Over, and myself and will be further developed in this book. While the emphasis and detail differ somewhat between theorists, there is a broad consensus that the two systems (or minds) might include the set of features listed in Table 1.2. I will examine the case for most of these in the course of this book. For example, I will ask whether the intuitive mind is an old mind, which evolved early, and whether the reflective mind should be thought of as a conscious mind. I will look at much evidence suggesting that we have distinct forms of knowledge, both in the form of explicit memories and beliefs available to the reflective

<table>
<thead>
<tr>
<th></th>
<th>Intuitive mind</th>
<th>Reflective mind</th>
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<tbody>
<tr>
<td>Reber</td>
<td>Implicit</td>
<td>Explicit</td>
</tr>
<tr>
<td>Epstein</td>
<td>Experiential</td>
<td>Rational</td>
</tr>
<tr>
<td>Chaiken</td>
<td>Heuristic</td>
<td>Systematic</td>
</tr>
<tr>
<td>Evans</td>
<td>Heuristic</td>
<td>Analytic</td>
</tr>
<tr>
<td>Sloman</td>
<td>Associative</td>
<td>Rule based</td>
</tr>
<tr>
<td>Various</td>
<td>Automatic</td>
<td>Controlled</td>
</tr>
<tr>
<td>Stanovich</td>
<td>System 1 (TASS)</td>
<td>System 2 (analytic)</td>
</tr>
<tr>
<td>Hammond</td>
<td>Intuitive</td>
<td>Analytic</td>
</tr>
<tr>
<td>Lieberman</td>
<td>Reflexive</td>
<td>Reflective</td>
</tr>
<tr>
<td>Nisbett</td>
<td>Holistic</td>
<td>Analytic</td>
</tr>
<tr>
<td>Wilson</td>
<td>Adaptive unconscious</td>
<td>Conscious</td>
</tr>
</tbody>
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mind, and habits and procedures that affect our behaviour through the intu-
itive mind. I will show that our two minds give us two different ways of reason-
ing, making decisions and of understanding and acting in the social world. 
Finally, I will show that while our two minds often cooperate they can also 
come into serious conflict with each other.

Notes and references

1 Philosophers of mind tend to use the term ‘folk psychology’ in a narrow sense to 
refer to the idea that behaviour is controlled by mental states—beliefs and desires—
without necessarily assuming that such states are conscious (Frankish, 2004). I use the 
term more broadly here to refer to the commonly-held—and quite possibility culturally 
influenced—sets of beliefs that people hold about human behaviour, at least in Western 
societies.
2 For a recent scholarly review of these theories see Evans (2008).
4 Our belief in conscious will is illusory. See Wegner (2002) and the discussion in 
Chapter 7.
5 This is common in the writings of social psychologists. For example, Wilson (2002) 
distinguishes the conscious mind from the ‘adaptive unconscious’.
6 For scholarly treatments of the history of the psychology of thinking see Reeves (1965) 
and Mandler and Mandler (1964).
7 Some evolutionary psychologists argue that belief in a blank slate persists in the social 
sciences to the present day, see Tooby and Cosmides (1992) and Pinker (2002). On this 
view, there is no innate knowledge and everything has to be learnt from scratch.
8 For detailed review of this work see Humphreys (1951).

<table>
<thead>
<tr>
<th>Intuitive mind</th>
<th>Reflective mind</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evolutionarily old</td>
<td>Evolutionarily recent</td>
</tr>
<tr>
<td>Shared with animals</td>
<td>Unique to humans</td>
</tr>
<tr>
<td>Unconscious, preconscious</td>
<td>Conscious</td>
</tr>
<tr>
<td>High capacity</td>
<td>Low capacity</td>
</tr>
<tr>
<td>Fast</td>
<td>Slow</td>
</tr>
<tr>
<td>Automatic</td>
<td>Controlled or volitional</td>
</tr>
<tr>
<td>Low effort</td>
<td>High effort</td>
</tr>
<tr>
<td>Parallel</td>
<td>Sequential</td>
</tr>
<tr>
<td>Implicit knowledge</td>
<td>Explicit knowledge</td>
</tr>
<tr>
<td>Contextualised, belief based</td>
<td>Abstract, decontextualised</td>
</tr>
<tr>
<td>Linked with emotion</td>
<td>No direct link with emotion</td>
</tr>
<tr>
<td>Independent of individual differences in general intelligence and working memory capacity</td>
<td>Correlated with individual differences in intelligence and working memory capacity</td>
</tr>
<tr>
<td>Ecological or evolutionary rationality</td>
<td>Normative rationality</td>
</tr>
</tbody>
</table>
9 One of Galton’s greatest works was his *Enquiries into Human Faculty and its Development* (Galton, 1893).

10 There are many philosophical positions on consciousness and the one implied here is called ‘double aspect monism’. For a detailed recent exposition of this approach, see Velmans (2000).

11 The field was identified in a brilliant review by Ulric Neisser (1967), the first of the now many books to be called *Cognitive Psychology*.

12 For an introduction to the philosophy of mind, including the computational approach as well as the problem of consciousness that is discussed in Chapter 7, see Ravenscroft (2005).


16 In fact, there are some important differences between these theories, which bear on the two minds hypothesis in somewhat different ways (see Evans, 2008a). Some theories propose competing implicit and explicit processes in manner that maps directly on to the two minds hypothesis. However, some deal with preconscious support processes for reflective thinking and others with different styles of reflective thought. The detail is not important at this stage and these different ideas will emerge in the course of the book.