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What's This Book About?

To put it simply, this book is about your memory: the good, the bad, and the sometimes beautiful. As memory researchers, we believe human memory is one of the most incredible products of evolution, every bit as stunning and captivating as a brightly coloured peacock. Even now, after many years of study and research, we marvel at the powerful, flexible, sometimes maddening nature of our memory systems. You might not give your memory that much thought in your day-to-day life. For you, it may just be something that ticks along in the background, like growing your toenails or controlling your body temperature. Memory might be something you only think about when it fails; when you can't remember the name of the person who is warmly greeting you, or when you miss an important appointment. In this book, we hope to convince you that memory is a key part of who you are, informing almost everything you say, do, or think. We argue that memory is imperfect, but *perfectly imperfect*. The 'flaws' are the best and most interesting parts, giving us insight into how—and why—our memory works the way it does.

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The key message that we hope to convey is that our memories are constantly adapting and changing as we encounter new information and reflect on the past. If remembering the events of your life is like taking a walk down memory lane, then each memory is not a listed building, with a preservation order maintaining it exactly as it was when it was first built. Instead, you might think of Memory Lane as a neighbourhood that is constantly under construction, with individual buildings being built, remodelled, and even razed to the ground. Our goal is to explain how this continuous reconstruction supports our daily activities, keeping our memories alive and lived in rather than perfectly preserved monuments to the past.

Just as important as what this book is about is what it is *not* about. We focus on the benefits and pitfalls of healthy memories, and we examine the insights into the evolution of memory that we gain from studying its occasional failures. We do not focus on age-related memory decline or dementia. This is an extremely important topic, but our focus is on healthy memory rather than pathology. The memory flaws that we talk about are the kind that we all experience every day in the absence of any clinical condition. This book is also not about techniques to improve or 'fix' your memory. This is not a self-help book. We take you on a journey through the most important scientific research in memory, touching on classic studies as well as cutting-edge modern research. You will gain new insights into your day-to-day memory, exploring issues like how you remember (or misremember) the events of your life, whether your memories can be trusted, whether you would make a good eyewitness, and even whether some of the events you recall might never have taken place. This is not the first book to examine the flawed nature of human memory. Here, we hope to balance the 'doom and gloom' that is sometimes associated with

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these undeniable problems by considering why our memories evolved to function in this way.

There are a variety of different levels at which we might study memory. At the most fundamental level, a molecular biologist might be interested in the chemical properties of neurotransmitters, such as dopamine and serotonin, and what happens when they are released in the brain. At this level, we can consider the role of individual cells, their chemical processes, and electrical activity. At the next level up, a neuroscientist might consider the activity of groups of cells and how they work in concert. For example, many researchers use techniques such as electroencephalography (EEG) to measure the electrical signals that are produced while we perform different tasks, or use functional magnetic resonance imaging (fMRI) to measure blood flow in the brain as a proxy for electrical activity. Moving up one more level, we might consider the activity of the organism as a whole—that is, human behaviour.

There is much to be learned from careful study at each of these levels of analysis; however, as psychologists, we are primarily interested in that wider perspective, examining how memories are experienced and how they influence our behaviour. In particular, we are interested in memory in real-life settings—how our memories enable us to make routine decisions and support our relationships and identities. For more than a decade, we have worked together to conduct research in applied cognitive psychology and have published dozens of experiments assessing attention, memory, and learning in real-world environments. Despite years in this field—attaining PhDs in cognitive psychology, running research projects, teaching our students about the topic—we remain as intrigued as ever. Though you may not have given your memory much thought up to this point, we hope by the conclusion of this book you will

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share our enthusiasm for closely examining memory in everyday settings.

In order to understand why this is the level of analysis we choose to work at, let's imagine a scenario:

> Ted is on trial for theft, accused of stealing a woman's handbag. Nina, a witness to the theft, has picked Ted out of a line-up, and identified him as the man who stole the bag. Ted maintains his innocence, and insists he has been wrongly accused.

We have been contacted by the defence team and asked to provide expert witness testimony as to the reliability of Nina's account. Of course, we cannot provide specific information about the memory of the particular witness in this case—there is simply no way to tell for certain if a person's recollection of a given event is accurate without corroborating evidence. There's also no infallible tool that can tell us whether someone is telling the truth, despite what television might have led you to believe about lie detector tests or our ability to interpret body language. We can however provide general commentary on the nature of eyewitness memory. As researchers who have worked in this field for many years, we can draw on a wealth of scientific research, including both our own studies and those of our colleagues. In this case, what kind of evidence would be most useful to a jury?

On the one hand, we could describe a hypothetical study in which fMRI was used to identify the average patterns of brain activity underlying correct (versus incorrect) identification of unfamiliar faces. The precise details of how neuroimaging studies are conducted are beyond the scope of this book, but they typically require the construction of a long series of carefully controlled stimuli that are presented to participants as they lie in an MRI scanner. For example, if you were a participant in a study like this, you might first be shown a series of facial images, as in the left panel of figure 1.1. Later, you might be shown a

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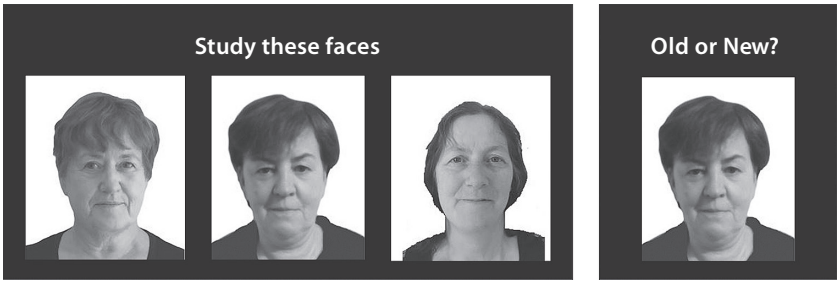

FIGURE 1.1. Sample trials from a facial recognition experiment of the type that might be conducted in an fMRI scanner.

FIGURE 1.2. A simulated crime from an eyewitness memory experiment. In this scenario, a man approaches a woman to ask for directions. While she is distracted, he steals her bag. They struggle briefly, he runs away, and she follows.

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second set of images and asked to indicate whether you had seen each one before, as in the right panel.

A study such as this can provide valuable information about the brain networks underlying facial recognition, but it probably won't tell us much about the practical use of this skill in day-to-day life, as in the case of our hypothetical eyewitness. Moreover, in order to study memory in this way, we have to strip away all its complexities and boil it down to its bare essentials. This can create an almost unbridgeable gap between the kind of memory task that is studied in the lab and the real-world operation of memory.

On the other hand, we could choose to tell the jury about a study in which we asked people to view a realistic reenactment of a crime, and later asked them to pick the perpetrator out of a line-up. We frequently run studies such as this in an effort to figure out how accurate the average eyewitness is, and to identify the factors that might influence their performance. To do this, we first ask participants to watch a video or slideshow depicting a simulated crime, like in figure 1.2.

Imagine that you are a participant in this study. Without looking back at the original images, can you identify the thief from the line-up in figure 1.3?

Depending on how much attention you paid to the faces in the scene, you might find this task rather difficult. This is because the faces are those of strangers. Rather than wasting precious mental resources on recording the faces of people we have never seen before (and will likely never see again), our memory systems prioritise the faces of those who form part of our social networks and whose actions we need to remember.

Let's go a little further. How many details can you remember from the scene depicted in the slideshow? Can you describe the clothing of the thief and victim? What about the theft itself—did the thief take the handbag with his left hand or right hand? Did he

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FIGURE 1.3. Suspect line-up. Can you identify the thief?*

knock anything off the table during the struggle? Did he elbow the woman in the face or the shoulder? How confident are you in your answers? Moreover, how confident are you that your memory will not change and your answers will stay the same over the weeks and months to come? You might be fairly confident in your answers right now, since you just saw the scene moments ago, and you were probably paying attention to the details. However, decades of research have shown that our memories for events like these are much more fallible than we realise. By focusing on the results of studies such as this, we can answer practical questions about the accuracy of eyewitness memory and the prevalence of memory distortion in the real world. We can reflect on the factors that might make memory errors more likely, including features of the scene, characteristics of the witness, and exposure to incorrect information about the crime after the fact. This kind of information might be more helpful to our hypothetical jury in determining how much faith to place in Nina's testimony.

We contend that the best way to understand memory performance in daily life is to use methods that mimic real-world circumstances as closely as possible. In our own work (and in this book), we primarily focus on behavioural studies of memory in

* Answer: D

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applied contexts, not because there is no value in research at the neural level, but because the specific questions we are posing are best suited to the behavioural level. Throughout our research careers, we have studied the vulnerabilities of memory through a variety of lenses, and have learned a number of important lessons. Over the course of this book, we describe the baked-in flaws in our memory systems that mean that many of our most cherished memories cannot be relied upon but, crucially, we also explain why and how our brains developed in this way. We describe work conducted by ourselves and others examining various methods of memory distortion and false memory implantation. Our work approaches memory from a number of different angles—in some studies, we try to implant false memories directly into people's minds, while in others we examine effects of exposure to 'fake news' and other forms of misinformation. In still others, we use driving simulators to mimic the conditions that a driver might experience while witnessing a traffic accident. What all of these experimental methods have in common is a drive to investigate the formation of memories in the real world, with all their messy complexities and social contexts.

Extensive research has clearly demonstrated that memory does not provide a perfect record of our lives. At first blush, this might seem like a bad thing; surely if memory is good for anything it should be to accurately record what we see and do. However, if we stop and think not just about what memory *is*, but what memory is *for*, we can begin to see things a little differently. Remember that, just like our bodies, our brains and minds have evolved over hundreds of thousands of years. The principles of evolutionary theory tell us that traits that have survived natural selection over millennia are likely adaptive in some way—that is, they provide some benefit to survival or reproduction. In this context, it is not obvious that a perfect

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memory is something we would necessarily have evolved. The ability to recall every last piece of information in perfect detail may sound wonderful, but this would be an enormous drain on our limited cognitive resources. Instead, our memories have evolved to allow us to remember the things that are likely to be of value to us in the future, and to forget those that are not. Our memories do not work like computers, perfectly preserving the past. Instead, we *reconstruct* our memories every time we recall them. The key theme of this book is that this is no accident or failure of evolution, but rather our memories doing exactly what we need them to do.

As a result of this evolutionary process, our memory systems have a number of flaws built in, including the propensity to take information from the environment and incorporate it into our reconstructed memories. One of the ways this happens is when verbal descriptions of an event colour our memories of what happened. For example, try now to recall the sequence of events depicted in the slideshow earlier in this chapter. If you read the questions we asked you immediately after looking at the images, it's likely that you now have some memory of the thief striking or pushing the woman. This is because we inserted the question, 'Did he elbow the woman in the face or the shoulder?' which implies that some physical altercation took place. In fact, the sequence of photographs did not show any physical contact between the pair during the struggle over the handbag. In later chapters we discuss this powerful phenomenon, the 'misinformation effect', and the severe consequences it can have in legal settings. We even describe how people can sometimes develop entirely false memories—memories of events that never happened. While reading this book, we want you to consider not only whether these memory distortions can occur, but why and how our memories are set up to mislead us in such a drastic fashion.

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We do, however, want to make one thing clear at the outset: discussions of the fallibility of memory (and especially eyewitness memory) can sometimes lead to the suggestion that victims of crime should not be believed when they report their experiences, or that their accounts are inherently untrustworthy. This is not our position, for several reasons. First, while everyone is susceptible to memory distortion, most of the time our memories work well enough, and we can report our experiences with reasonable accuracy. Second, victims of crime are no more likely to suffer memory errors than anyone else, including the accused perpetrators of those crimes. We discuss work directly addressing this topic later in the book. While we should always have a healthy degree of skepticism about the reliability of memory—our own and others'—we should not interpret research findings as suggesting that people who come forward should be automatically disbelieved. For this reason, memory errors are a sensitive subject of research. Later in this book we discuss the particular ethical issues of questioning and manipulating memory.

Our reconstructive memory systems present certain challenges, but they also bring many benefits, including helping us to maintain a coherent identity, strengthen social bonds, and vividly imagine possible futures. While the mental abilities that support all of these activities evolved in the far-distant past, they also allow us to adapt to totally novel circumstances. In the later chapters of this book, we consider how our memories respond in the face of new technologies, such as the use of body-worn cameras, and the rise of online 'fake news' and 'deepfakes'. We also ask how the distortion of memory under these circumstances affects our daily behaviour. We hope that this book will help you understand how the reconstructive nature of memory affects our regular lives in the modern world—for better and for worse.

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